Evaluation of and Recommended Determination on a Resource Management Plan (RMP), Pursuant to the Salmon and Steelhead 4(d) Rule

TITLE OF RMP:	Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component
RMP PROVIDED BY:	Puget Sound Treaty Tribes, Washington Department of Fish and Wildlife
FISHERIES:	Strait of Juan de Fuca, Hood Canal, and Puget Sound salmon fisheries and steelhead net fisheries potentially impacting listed Puget Sound chinook salmon
EVOLUTIONARILY SIGNIFICANT UNIT AFFECTED:	Puget Sound Chinook Salmon
NWR TRACKING NUMBER:	2004/01962
DATE:	January 27, 2005

Introduction:

On March 24, 1999, the National Marine Fisheries Service (NMFS) listed the Puget Sound chinook salmon (*Oncorhynchus tshawytscha*) as a threatened species under the Endangered Species Act of 1973 (ESA) (64 FR 14308). The Puget Sound Chinook Salmon Evolutionarily Significant Unit[1] (ESU) includes all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound from the Elwha River, eastward. Major river systems within the ESU supporting chinook salmon populations include the Nooksack, Skagit, Stillaguamish, Snohomish, Cedar, Duwamish-Green, White, Puyallup, Nisqually, Skokomish, Mid-Hood Canal, Dungeness, and Elwha Rivers. Chinook salmon (and their progeny) from the following hatchery stocks are also currently listed under the ESA: Kendall Creek (North Fork Nooksack River); North Fork Stillaguamish River; White River; Dungeness River; and Elwha River.

On July 10, 2000, NMFS issued a rule under section 4(d) of the ESA (referred hereafter as the ESA 4(d) Rule), establishing take prohibitions for 14 salmon and steelhead ESUs, including the Puget Sound Chinook Salmon ESU (50 CFR 223.203(b)(6); July 10, 2000, 65 FR 42422). The ESA 4(d) Rule provided limits on the application of the take prohibitions, i.e., take prohibitions would not apply to the plans and activities set out in the rule if those plans and activities met the

[1] An Evolutionarily Significant Unit or “ESU” is a collection of one or more Pacific salmon populations that share similar genetic, ecological, and life history traits but differ in important ways from salmon in other ESUs. Salmon ESUs are considered to be "distinct population segments" under the Federal Endangered Species Act (ESA).

rule's criteria. One of those limits (Limit 6) applies to joint tribal and state resource management plans.

On March 18, 2004, the Puget Sound Treaty Tribes (PSTT) and the Washington Department of Fish and Wildlife (WDFW) provided a jointly developed resource management plan to NMFS, Northwest Regional Office. The resource management plan, titled the “Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component,” dated March 1, 2004 (hereafter referred to as the RMP), provides the framework within which the tribal and state jurisdictions would jointly manage all salmon and gillnet steelhead fisheries that may impact listed chinook salmon within the greater Puget Sound area. The greater Puget Sound area consists of the State of Washington waters from the mouth of the Strait of Juan de Fuca at Cape Flattery, eastward.

The co-managers propose that the resource management plan be in effect for six years, from May 1, 2004, through April 30, 2010. However, a biological opinion issued by NMFS on June 10, 2004, titled “Effects of Programs Administered by the Bureau of Indian Affairs supporting tribal salmon fisheries management in Puget Sound and Puget Sound salmon fishing activities authorized by the U.S. Fish and Wildlife Services during the 2004 fishing season”, is effective through April 30, 2005 (2004a). Therefore, NMFS’ evaluation and determination under the ESA 4(d) Rule will only address May 1, 2005 to April 30, 2010 of the proposed duration of the RMP.

Recommended Pending Determination:

It is the recommended determination of NMFS Northwest Region’s Sustainable Fisheries Division, that implementing the resource management plan, titled the “Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component,” from May 1, 2005 to April 30, 2010, would not appreciably reduce the likelihood of survival and recovery of the Puget Sound Chinook Salmon ESU. The Sustainable Fisheries Division recommends that the Regional Administrator determine that the RMP adequately addresses the criteria established for Limit 6 of the ESA 4(d) Rule for the listed Puget Sound Chinook Salmon ESU. If the Regional Administrator so determines, the take prohibitions would not apply to fisheries implemented in accordance with the RMP. The discussion of the biological analysis underlying this recommended determination follows.

Evaluation:

The ESA 4(d) Rule for the Puget Sound Chinook Salmon ESU states that the prohibitions of paragraph (a) of the rule (16 U.S.C. 1531-1543) do not apply to actions taken in compliance with a resource management plan jointly developed by the States of Washington, Oregon and/or Idaho and the Tribes, provided that: (1) The Secretary has determined pursuant to 50 CFR 223.209 (referred to as the Tribal ESA 4(d) Rule) and the government-to-government processes therein that implementing and enforcing the joint tribal/state plan will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs; and (2) in making the determination for a resource management plan submitted under Limit 6, the Secretary of Commerce has taken comment on how any fishery management plan addresses the criteria described under Limit 4 (Sec. 223.203(b)(4)) of the ESA 4(d) Rule (50 C.F.R. 223.203(b)(6)).

Regarding the first element, NMFS consulted with the PSTT during the development of the RMP through government-to-government meetings. Consistent with legally enforceable tribal rights and with the Secretary of Commerce's tribal trust responsibilities, NMFS provided technical assistance, exchanged information, and discussed what is needed to provide for the conservation of listed species with the PSTT.

Regarding the second element, as required in section (b)(6)(iii) of the ESA 4(d) Rule, the RMP must adequately address eleven criteria under Limit 4 section (b)(4)(i). The criteria under Limit 4 section (b)(4)(i) are outlined in Table 1.

Table 1. Description of the eleven criteria for an RMP under Limit 4 section (b)(4)(i), and the page on which the evaluation of the RMP on each criterion starts within this document.

Criterion	Section	Description	Evaluation of the RMP on the criterion starts on page:
1	Section (b)(4)(i)	Clearly defines its intended scope and area of impact.	4
2	Section (b)(4)(i)	Sets forth the management objectives and the performance indicators for the plan.	4
3	Section (b)(4)(i)(A)	Defines populations within affected Evolutionarily Significant Units, taking into account: spatial and temporal distribution, genetic and phenotypic diversity, and other appropriate identifiably unique biological and life history traits.	19
4	Section (b)(4)(i)(B)	Uses the concepts of ''viable'' and ''critical'' salmonid population thresholds, consistent with concepts in the Viable Salmonid Populations (VSP) paper (NMFS 2000b)	24
5	Section (b)(4)(i)(C)	Sets escapement objectives or maximum exploitation rates for each management unit or population based on its status, and assures that those rates or objectives are not exceeded.	47
6	Section (b)(4)(i)(D)	Displays a biologically based rationale demonstrating that the harvest management strategy will not appreciably reduce the likelihood of survival and recovery of the Evolutionarily Significant Unit in the wild, over the entire period of time the proposed harvest management strategy affects the population, including effects reasonably certain to occur after the proposed actions cease.	66
7	Section (b)(4)(i)(E)	Includes effective (a) monitoring and (b) evaluation programs to assess compliance, effectiveness, and parameter validation.	79
8	Section (b)(4)(i)(F)	Provides for (a) evaluating monitoring data; and (b) making any revisions of assumptions, management strategies, or objectives that data show are needed.	81
9	Section (b)(4)(i)(G)	Provides for (a) effective enforcement, (b) education, (c) coordination among involved jurisdictions.	83
10	Section (b)(4)(i)(H)	Includes restrictions on resident and anadromous species fisheries that minimize any take of listed species, including time, size, gear, and area restrictions.	84
11	Section (b)(4)(i)(I)	Is consistent with other plans and conditions established within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.	85

This evaluation will address each of the criteria separately, in the order as provided in the ESA 4(d) Rule. Some criteria require NMFS to evaluate the RMP's impacts on individual populations. However, the ESU, not the individual populations within the ESU, is the listed entity under the ESA. Evaluation of the estimated aggregate impacts on the ESU, resulting from the implementation of the RMP, will occur when addressing criterion 6.

The following is the Sustainable Fisheries Division's evaluation of the RMP's adequacy in addressing the eleven criteria specified in Limit 4, section (b)(4) of the ESA 4(d) Rule for the Puget Sound Chinook Salmon ESU.

(1) Section (b)(4)(i) Clearly defines its intended scope and area of impact.

The Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component clearly defines the intended scope of the fisheries management regime and its rather broad area of impact. The RMP guides the implementation of salmon fisheries and steelhead net fisheries under the co-managers' jurisdiction that may affect Puget Sound chinook salmon in Washington waters from the mouth of the Strait of Juan de Fuca at Cape Flattery, eastward. This geographic scope (referred hereafter as the Puget Sound Action Area) encompasses the area included in the Puget Sound Chinook Salmon ESU, as well as the western portion of the Strait of Juan de Fuca within the United States (Figure 1). NMFS evaluated the RMP for implementation during the next five fishing seasons, encompassing annual fishing seasons from May 1, 2005, through April 30, 2010.

(2) Section (b)(4)(i) Sets forth the management objectives and the performance indicators for the plan.

The RMP's stated objective is to ensure that "fishery-related mortality will not impede rebuilding of natural Puget Sound chinook salmon populations, to levels that will sustain fisheries, enable ecological functions, and are consistent with treaty-reserved fishing rights" (see page 3 of the RMP).

The guiding principles of the RMP are listed on pages 3 and 4 and include: (1) conserve the productivity, abundance, and diversity of all populations within the Puget Sound Chinook Salmon ESU; (2) manage for risk and uncertainty; (3) meet the ESA jeopardy standards; (4) provide opportunity to harvest surplus production from other species and populations; (5) account for all sources of fishery-related mortality (including non-landed mortality); (6) follow the principles of the Puget Sound Salmon Management Plan (PSSMP 1985) and other legal mandates pursuant to *U.S. v. Washington* (384 F. Supp. 312 (W.D. Wash. 1974)); (7) achieve the guidelines on allocations of harvest and conservation objectives that are defined in the 1999 Annex IV, Chapter 3, Chinook Salmon of the Pacific Salmon Treaty (PST 1999); and, (8) protect Indian treaty rights.

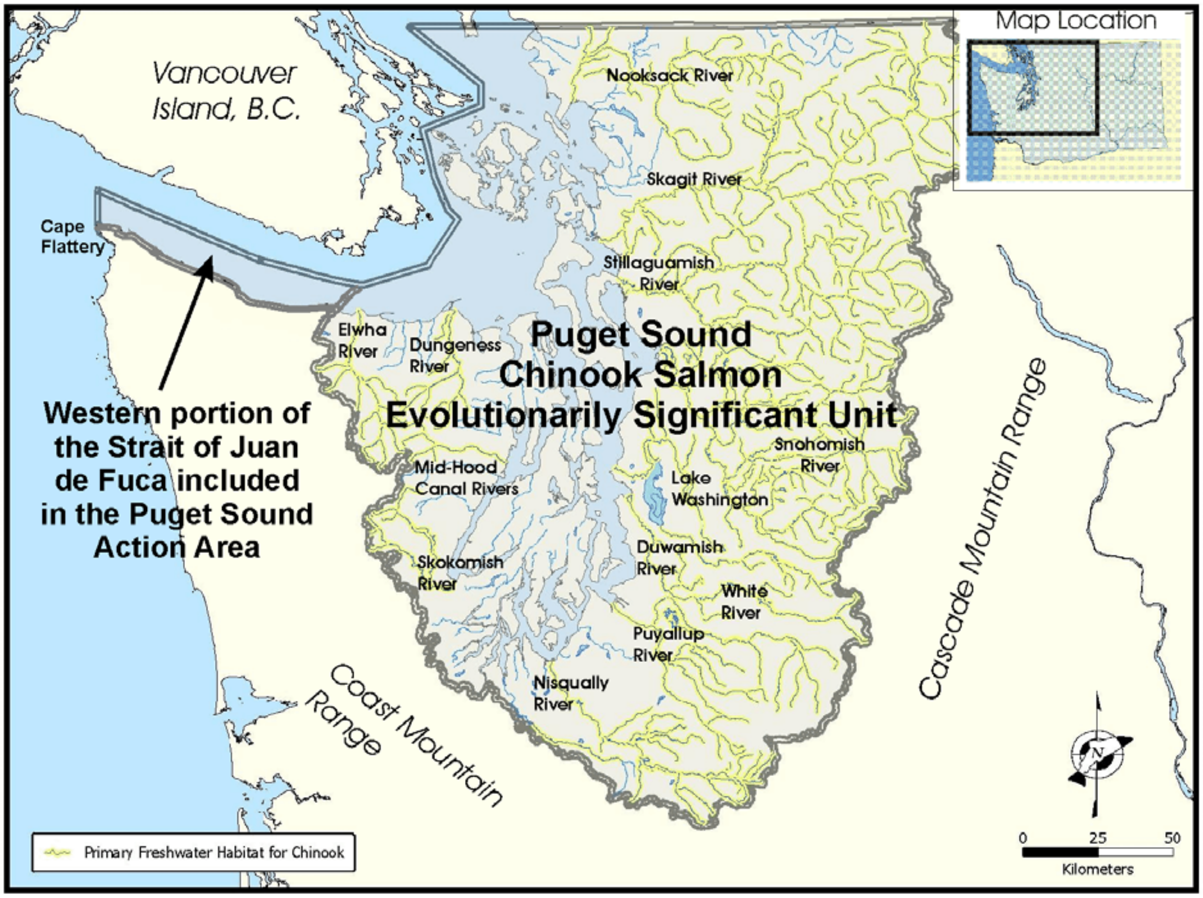
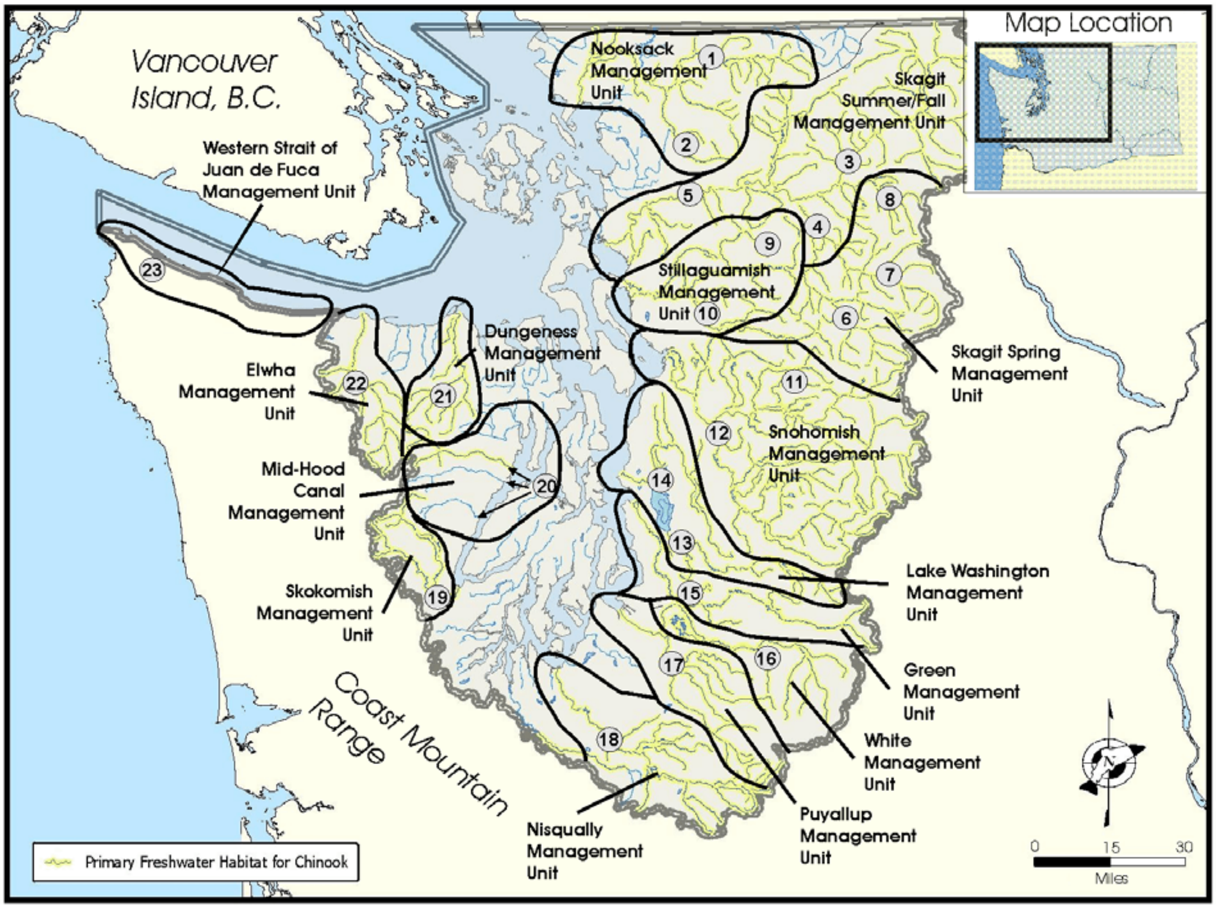


Figure 1. Puget Sound Action Area, which includes the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU) and the western portion of the Strait of Juan de Fuca in the United States.

The RMP contains biologically-based management objectives that are generally expressed in terms of population-specific exploitation rates or escapement goals. In general, fisheries are managed to achieve these biological objectives, but there is a base level, referred to as the minimum fisheries regime, which the fisheries would not go below. A minimum fisheries regime is triggered by population-specific low abundance thresholds. From the co-managers' perspective, the RMP strikes a balance between biological and policy objectives by addressing conservation concerns "while still allowing a reasonable harvest of non-listed salmon" (page 17 of the RMP).

Performance Indicators:

The RMP provides a framework for fisheries management measures affecting 23 chinook salmon populations. Twenty-two populations are within the Puget Sound Chinook Salmon ESU, and one population (the Hoko River) is located in the western portion of Strait of Juan de Fuca (Figure 2).



Key: Chinook salmon populations.

1 - North Fork Nooksack River
2 - South Fork Nooksack River
3 - Upper Skagit River
4 - Lower Sauk River
5 - Lower Skagit River
6 - Upper Sauk River
7 - Siuattle River
8 - Upper Cascade River
9 - North Fork Stillaguamish River
10 - South Fork Stillaguamish River
11 - Skykomish River
12 - Snoqualmie River
13 - Cedar River
14 - Sammamish River
15 - Duwamish-Green River
16 - White River
17 - Puyallup River
18 - Nisqually River
19 - Skokomish River
20 - Mid-Hood Canal Rivers
21 - Dungeness River
22 - Elwha River
23 - Hoko River

Figure 2. Location of the RMP's salmon populations and management units within the Puget Sound Action Area. One salmon population identified in the RMP, the Hoko River (23), is not within the Puget Sound Chinook Salmon ESU.

The populations within the ESU are consistent with those defined by the Puget Sound Technical Recovery Team (TRT)[2]. For harvest management purposes, the RMP distributes the 23 populations among the 15 management units (Table 2). The RMP defines a management unit as a "stock or group of stocks which are aggregated for the purpose of achieving a management objective" (page 64 of the RMP). Six of the fifteen management units contain more than one

[2] The Puget Sound Technical Recovery Team (TRT) is an independent scientific body convened by NMFS to develop technical delisting criteria and guidance for salmon delisting in Puget Sound.

population, as defined by the co-managers. These populations are annually monitored by the co-managers, and their status will be used as the performance indicators for the RMP.

Sources of mortality for listed chinook salmon include fish killed incidentally in fisheries directed at unlisted chinook salmon or species, and fish taken in fisheries directed at listed chinook salmon. However, the co-managers foresee that “nearly all of the anticipated harvest-related mortality to natural [listed] Puget Sound chinook [salmon, under the implementation of the RMP,] will be incidental to fisheries directed at other stocks or species” (page 5 of the RMP). The RMP proposes the implementation of restrictions to the cumulative directed and incidental fishery-related mortality to each Puget Sound chinook salmon population or management unit. The RMP’s restrictions to the cumulative fishery-related mortality are expressed as: (1) a rebuilding exploitation rate; (2) an upper management threshold; (3) a low abundance threshold; and (4) a critical exploitation rate ceiling (Table 2). The following is a brief description of these RMP’s limits:

(1) Rebuilding Exploitation Rate

The RMP’s rebuilding exploitation rates are outlined in Table 2. The co-managers define exploitation rate as the “[t]otal mortality in a fishery or aggregate of fisheries expressed as the proportion of the sum of total mortality plus escapement” (page 63 of the RMP). The co-managers’ management objectives and tools have been evolving since the early 1990s in response to the declining status of Puget Sound salmon populations (page 6 of the RMP). When compared to pre-1990 management objectives, the co-managers propose that the RMP’s rebuilding exploitation rate for the individual management units would improve the viable status of the chinook salmon population or populations within that management unit. The intent of the co-managers is to not exceed the management unit’s rebuilding exploitation rate (see page 1 of the RMP). The co-managers used several methods to derive the RMP’s rebuilding exploitation rates.

NMFS also established rebuilding exploitation rates for nine individual populations within the ESU and for the Nooksack Management Unit, which will be discussed in more detail later in this document. For individual populations, NMFS has determined that exploitation rates at or below NMFS-derived rebuilding exploitation rates will not appreciably reduce the likelihood of rebuilding that population, assuming current environmental conditions based on specific risk criteria. The method used by NMFS to derive the rebuilding exploitation rates is described in a document titled “A risk assessment procedure for evaluating harvest mortality of Pacific salmonids,” dated May 30, 2000 (NMFS 2000a). This evaluation will include comparing the anticipated exploitation rates with the implementation of the RMP against NMFS-derived rebuilding exploitation rates.

Table 2. The RMP's management objectives (rebuilding exploitation rate, upper management threshold, low abundance thresholds, and the critical exploitation rate ceiling), by management units and populations.

Management Unit	Population [1]	Rebuilding Exploitation Rate [2]	Upper Management Threshold	Low Abundance Threshold	Critical Exploitation Rate Ceiling
Nooksack		-	4,000	-	9% SUS
	North Fork Nooksack River	-	2,000	1,000 [3]	-
	South Fork Nooksack River	-	2,000	1,000 [3]	-
Skagit		50%	14,500	4,800	15% SUS
Summer/Fall	Upper Skagit River	-	8,434	2,200	Even-Years
	Lower Sauk River	-	1,926	400	17% SUS
	Lower Skagit River	-	4,140	900	Odd-Years
Skagit Spring		38%	2,000	576	18% SUS
	Upper Sauk River	-	986	130	-
	Suiattle River	-	574	170	-
	Upper Cascade River	-	440	170	-
Stillaguamish		25%	900	650 [3]	15% SUS
	North Fork Stillaguamish River	-	600	500 [3]	-
	South Fork Stillaguamish River	-	300	-	-
Snohomish		21%	4,600	2,800	15% SUS
	Skykomish River	-	3,600	1,745 [3]	-
	Snoqualmie River	-	1,000	521 [3]	-
Lake Washington		15% PT SUS	-	-	12% PT SUS
	Cedar River	-	1,200	200 [3]	-
	Sammamish River [7]	-	-	-	-
Green	Duwamish-Green River	15% PT SUS	5,800	1,800	12% PT SUS
White River	White River	20%	1,000	200	15% SUS
Puyallup	Puyallup River	50%	-	500	12% PT SUS
	(South Prairie Creek Index Area)	-	500	-	
Nisqually	Nisqually River	-	1,100	-	- [4]
Skokomish	Skokomish River	15% PT SUS	3,650 [5]	1,300 [6]	12% PT SUS
Mid-Hood Canal	Mid-Hood Canal Rivers	15% PT SUS	750	400	12% PT SUS
Dungeness	Dungeness River	10% SUS	925	500	6% SUS

Elwha	Elwha River	10% SUS	2,900	1,000	6% SUS
Western Strait of Juan de Fuca	Hoko River	10% SUS	950	500	6% SUS

[1] Populations are consistent with the populations preliminarily recognized by the Puget Sound Technical Recovery Team (TRT) within the Puget Sound Chinook Salmon ESU. The Western Strait of Juan de Fuca Management Unit is not within the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU).

[2] Exploitation rates are expressed as either total, southern United States (SUS), or pre-terminal southern United States (PT SUS). The SUS fishery includes all fisheries south of the border with Canada that may harvest listed Puget Sound chinook salmon. The SUS fishery includes both pre-terminal SUS and terminal SUS fisheries. The co-managers define a pre-terminal fishery as a "fishery that harvests significant numbers of fish from more than one region of origin" (page 65 of the RMP). The co-managers define a terminal fishery as a "fishery, usually operating in an area adjacent to or in the mouth of a river, which harvests primarily fish from the local region of origin, but may include more than one management unit" (page 65 of the RMP). The terminal SUS fisheries will vary by management unit and may occur in freshwater and marine areas.

[3] These thresholds are designated as representing natural-origin spawners by the co-managers. A natural-origin spawner is any naturally spawning salmon that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. "Natural-origin spawner" is synonymous with "wild fish" in the RMP. "Natural spawner" is any naturally spawning salmon (hatchery or natural-origin).

[4] The Nisqually Management Unit is managed to achieve a 1,100 natural spawner escapement goal.

[5] Skokomish Management Unit's upper escapement goal of 3,650 spawners is composed of 1,650 natural-origin spawners and 2,000 hatchery-return spawners. If the recruit abundance is insufficient for the upper escapement goal to be met, *or* regardless of the total escapement, if the naturally spawning component of the Skokomish River population is expected to fall below 1,200 spawners, *or* the hatchery component is expected to result in less than 1,000 spawners, additional terminal fishery management measures would be taken, with a lower escapement objective of meeting or exceeding the 1,200 naturally spawning fish (see page 175 of the RMP).

[6] Skokomish Management Unit's low abundance threshold of 1,300 spawners is composed of 800 natural-origin spawners and 500 hatchery-return spawners.

[7] Usually referred to as the "north Lake Washington tributaries population" in the RMP.

The NMFS-derived rebuilding exploitation rates for individual chinook salmon populations may not be the same as the RMP's rebuilding exploitation rates. The co-managers' rebuilding exploitation rates are management unit based, which may contain more then one chinook salmon population. Some of the RMP's rebuilding exploitation rates are based on the same risk criteria as those used by NMFS. However, other RMP's rebuilding exploitation rates are based on observed minimum exploitation rates or on harvest ceilings set by the Pacific Salmon Treaty. In addition, NMFS-derived rebuilding exploitation rates are for all fishery-related mortality throughout the migratory range of Puget Sound chinook salmon. The RMP's rebuilding exploitation rates are in terms of either total, southern United States (SUS), or pre-terminal southern United States (PT SUS) and may not be directly comparable to NMFS-derived rebuilding exploitation rates.

The SUS fishery includes all fisheries south of the border with Canada that may harvest listed Puget Sound chinook salmon. This would include listed chinook salmon that are taken in fisheries off the coast of Washington, Oregon, and northern California. The SUS fishery includes both pre-terminal SUS and terminal SUS fisheries. The co-managers define a pre-terminal fishery as a "fishery that harvests significant numbers of fish from more than one region of origin" (page 65 of the RMP). The co-managers define a terminal fishery as a "fishery, usually operating in an area adjacent to or in the mouth of a river, which harvests primarily fish from the local region of origin, but may include more than one management unit. Non-local stocks may be present, particularly in marine terminal areas" (page 65 of the RMP). The terminal SUS fisheries will vary by management unit and may occur in freshwater and marine areas.

Calculating a rebuilding exploitation rate ideally requires knowledge of a spawner-recruit relationship based on escapement, age composition, coded-wire tag distribution, environmental parameters, and management error (N. Sands, NMFS, Northwest Fisheries Science Center (NWFSC), pers. com., to K. Schultz, NMFS, March 5, 2003). These types of data are available for several management units. The co-managers calculated the rebuilding exploitation rates using this method for the Skagit Summer/Fall, Skagit Spring, Stillaguamish, and Snohomish Management Units.

The co-managers' expectations are that application of these RMP's rebuilding exploitation rates will: (1) result in escapement levels that are less than the point of instability[3] no more than five percent more often than if no harvest had occurred over 25 or 40 years[4]; *and* (2) lead to a high (at least 80 percent) probability that spawning escapements will increase in 25 or 40 years to a specified (upper) threshold, *or* that the percentage of escapements less than the RMP's low abundance threshold at the end of 25 or 40 years will differ from a no-harvest regime by less than 10 percent (pages 13 and 14 of the RMP). Appendix A: Management Unit Status Profiles of

[3] The co-managers define the point of instability as "that level of population abundance (i.e., spawning escapement) that incurs substantial risk to genetic integrity, or exposes the stock to depensatory mortality factors" (page 65 of the RMP).

[4] Based on co-manager's expertise and explained in more detail in Appendix A: Management Unit Status Profiles of the RMP. The RMP uses a 25-year projection for the Stillaguamish and Snohomish Management Units in development of the proposed rebuilding exploitation rate. The co-managers used a 40-year projection for the Skagit Summer/Fall and Skagit Spring Management Units.

the RMP provides details on the methods the co-managers used to develop the RMP's rebuilding exploitation rates, which are based on a spawner-recruit relationship.

The data required to calculate a spawner-recruit relationship is not yet available for most Puget Sound chinook salmon populations. For the data-poor Lake Washington, Skokomish, and Mid-Hood Canal Management Units, the co-managers generally established the RMP's rebuilding exploitation rate at the lowest level of exploitation rates observed in the late 1990s (approximately 15 percent pre-terminal SUS). Overall, implementation of these lower exploitation rate levels by the co-managers has contributed to stable to increasing spawning escapement trends for populations within these management units.

Impacts associated with terminal fisheries would not be included in a pre-terminal SUS exploitation rate. Similar to recent years, the co-managers propose that the terminal fisheries in the Lake Washington and Mid-Hood Canal Management Units would have an exploitation rate of less than 5 percent. With the implementation of the RMP, the Skokomish Management Unit's terminal fisheries would be managed for a series of escapement objectives. The achievement of Skokomish Management Unit's escapement objectives would dictate the appropriate terminal exploitation rate.

Terminal fishery impacts are very low or non-existent in the Dungeness, Elwha, and Western Strait of Juan de Fuca Management Units. With the implementation of the RMP, the co-managers propose a rebuilding exploitation rate for these three management units of 10 percent SUS. The SUS fisheries include both pre-terminal SUS and terminal SUS fisheries. Thus, impacts associated with Alaska or Canadian fisheries would not be included in this SUS fishery exploitation rate limitation.

(2) Upper Management Threshold

Table 2 outlines the proposed RMP's upper management thresholds. The co-managers define the upper management threshold as the "escapement level associated with optimum productivity (i.e. maximum sustainable harvest........)" (page 12 of the RMP). The co-managers calculated the RMP's upper management threshold under current habitat conditions (page 13 of the RMP). The upper management thresholds proposed in the RMP equates to the upper escapement thresholds.

The RMP's annual management strategy depends on whether a harvestable surplus is forecast. A management unit is considered to have a harvestable surplus if the spawning escapement is expected to exceed its upper management threshold (page 12 of the RMP). The RMP prohibits directed harvest on listed populations of Puget Sound chinook salmon unless they have harvestable surplus. In other words, if a management unit does not have a harvestable surplus, then harvest-related mortality would be constrained to incidental impacts (see page 32 of the RMP).

With an exception, the RMP states that the "projected exploitation rate for management units with no harvestable surplus [and above their lower abundance threshold] will not be allowed to exceed their rebuilding exploitation rate ceiling" (see page 33 of the RMP). The exception is associated with the chinook salmon harvest in Canadian fisheries, which were approved under the Pacific Salmon Treaty. For those management units affected by Canadian fisheries, in some years the RMP's critical exploitation rate ceiling may be the restraining limit on Puget Sound fisheries, with the total exploitation rate in that year exceeding the RMP's rebuilding exploitation rate (see discussion of the RMP's critical exploitation rate ceiling below).

The technical basis for the RMP's upper management thresholds varies among management units (see footnotes on Table 12, page 43 of the RMP). For populations with sufficient information, the co-managers derived upper management thresholds using such methods as standard spawner-recruit calculations (Ricker 1975), empirical observations of relative escapement levels and catches, or Monte Carlo simulations that buffer for error and variability (Hayman 2003). The method used by the co-managers in establishing the upper management threshold for each management unit is described in Appendix A: Management Unit Status Profiles of the RMP.

(3) Low Abundance Threshold

Table 2 provides the RMP's proposed low abundance thresholds. The co-managers define the low abundance threshold as a "spawning escapement level, set intentionally above the point of biological instability, which triggers extraordinary fisheries conservation measures to minimize fishery related impacts and increase spawning escapement" (page 63 of the RMP).

The co-managers defined the RMP's low abundance thresholds as: (1) the lowest escapement with a greater than one return per spawner ratio; (2) the forecasted escapement for which there is "acceptably low" probability that the observed escapement will be below the point of instability (see page 15 of the RMP); or (3) in cases where specific data were lacking, the co-managers derived the RMP's low abundance threshold "in accordance with scientific literature [such as the generic guidelines found in the Viable Salmonid Populations (VSP) paper (NMFS 2000b)] or more subjectively, at annual escapement of 200 to 1,000" (see page 15 in the RMP). The method chosen by the co-managers depended on the quality and quantity of population-specific data available (see Appendix A: Management Unit Status Profiles of the RMP).

(4) Critical Exploitation Rate Ceiling

The co-managers established a critical exploitation rate ceiling for all management units with a low abundance threshold (see Table 2). For most management units, the RMP's critical exploitation rate ceiling imposes an upper limit on SUS exploitation rates when spawning escapement for a management unit is projected to fall below its low abundance threshold *or* if Canadian fisheries make it difficult or impossible to achieve the RMP's rebuilding exploitation rate. The RMP's rebuilding exploitation rate, the upper management threshold, and the low abundance threshold discussed above are primarily biologically-driven objectives. The RMP's critical exploitation rate ceilings are primarily driven by policy consideration.

The co-managers propose that the critical exploitation rate ceiling, when imposed on SUS fisheries, would result "in a significant reduction in incidental impacts on listed chinook salmon," while providing "minimally acceptable access" to non-listed salmon species, including non-listed hatchery chinook salmon, for which harvestable surpluses have been identified (see page 15 of the RMP). The RMP provides a general description of the fisheries, which represents the lowest level of fishing mortality on listed chinook salmon proposed by the co-managers. A description of these minimal fisheries is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

For the majority of the management units, the RMP’s critical exploitation rate ceilings are defined as an exploitation rate ceiling for the all SUS fisheries. For the Lake Washington, Green, Puyallup, Nisqually, Mid-Hood Canal and Skokomish Management Units, the RMP’s critical exploitation rate ceiling applies only to the pre-terminal SUS fisheries. For these units, the co-managers outline additional terminal fishery management conservation measures that may be considered (Appendix A: Management Unit Status Profiles and Appendix C: Minimum Fisheries Regime of the RMP).

The RMP’s critical exploitation rate ceilings were established by the co-managers, after policy consideration of “recent fisheries regimes that responded to critical status for some management units” (see page 17 of the RMP). The co-managers’ position is that if further resource protection is necessary, it must be found by reducing exploitation rates in mixed-stock fisheries in Alaska and Canada, improving habitat conditions, and/or providing artificial supplementation where necessary and appropriate (see page 16 of the RMP). However, where analysis can demonstrate that additional conservation measures in fisheries would contribute substantially to recovery of a management unit, the co-managers may, at their discretion, and in concert with other specific habitat and enhancement actions, implement them (see page 34 of the RMP).

Harvest in some coastal fisheries in British Columbia, Canada has increased recently, approaching the limits agreed to by the United States under Annex IV, Chapter 3 of the Pacific Salmon Treaty. Increased impacts on Puget Sound chinook salmon associated with Canadian fisheries may contribute to the total exploitation rates exceeding the proposed RMP’s rebuilding exploitation rate. During preseason planning, if the total exploitation rate for a management unit is projected to exceed the RMP’s rebuilding exploitation rate for a given management unit, the co-managers propose to constrain their fisheries such that either the RMP’s rebuilding exploitation rate is not exceeded *or* the RMP’s critical exploitation rate ceiling is not exceeded. The RMP’s critical exploitation rate ceiling, in this circumstance, would constrain SUS fisheries to the same degree as if the abundance were below the low abundance threshold (see page 35 of the RMP). Modeling exercises by the co-managers demonstrate the potential for the total exploitation rate to exceed the RMP’s rebuilding exploitation rate in several management units during the duration of the proposed RMP.

Anticipated impacts under the implementation of the RMP:

The co-managers, in cooperation with NMFS, have modeled the anticipated impacts under the implementation of the RMP. Appendix A of this evaluation contains the individual model run results. Table 3 provides the anticipated range of exploitation rates and anticipated escapements for Puget Sound chinook salmon under the implementation of the RMP.

Table 3. Anticipated range of the annual total exploitation rates, southern United States (SUS) exploitation rates, and escapements for Puget Sound chinook salmon by management unit under the implementation of the RMP from May 1, 2005 through April 2010. Unless otherwise noted, exploitation rates and escapements are for natural fish.

Management Unit	Range of Anticipated Total Exploitation Rates	Range of Anticipated SUS Exploitation Rates	Range of Anticipated Pre-terminal SUS Exploitation Rates	Range of Anticipated Escapements
Nooksack (early) [1]	20 to 26%	7%	2 to 3%	252 to 388
Skagit Summer/Fall	48 to 56%	16 to 18% [2]	8 to 9%	7,551 to 11,633
Skagit Spring	23 to 28%	14 to 15%	12 to 13%	1,270 to 1,921
Stillaguamish [1]	17 to 20%	11 to 12%	10 to 11%	1,584 to 2,322
Snohomish [1]	19 to 23%	13 to 14%	11 to 12%	3,399 to 5,073
Lake Washington	31 to 38%	20 to 23%	9 to 10%	428 to 610
Duwamish-Green	49 to 63%	36 to 51%	9 to 10%	5,800 EG [3]
White	20%	17 to 19%	8 to 9%	1,011 to 1,468
Puyallup	49 to 50%	35 to 39%	9 to 10%	1,798 to 2,419
Nisqually	64 to 76%	53 to 68%	24 to 26%	1,100 EG [3]
Skokomish	45 to 63%	26 to 50%	12 to 13%	1,200 EG [3]
Mid-Hood Canal	26 to 34%	12 to 13%	12 to 13%	344 to 531
Dungeness	22 to 29%	5%	4 to 5%	231 to 356
Elwha	22 to 30%	5%	4 to 5%	1,395 to 2,125

[1] Based on natural-origin fish.
[2] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent years, 6 to 18 percent exploitation rates.
[3] Management units are managed by the co-managers to achieve natural spawner escapement goals (EGs).

Two variables were used in the modeling of the future fisheries to provide these anticipated ranges of exploitation rates and anticipated escapements. These variables were abundance of returning salmon and impacts associated with the level of Canadian fisheries.

Abundance Variable - The modeled salmon abundance in 2003 was used to estimate the upper end of the annual abundance returns under the implementation of the RMP from May 1, 2005 through April 2010. A 30 percent reduction from the 2003 abundance was used to represent the lower range of modeled returns. This range of modeled abundance is considered conservative. Given the general trend of stable to increasing abundance, which will be discussed later in this document, it is likely that if the actual abundance in the next five years falls outside this range, the actual abundance would most likely be greater. Of these two abundance scenarios, the most likely abundance to occur under the implementation of the RMP from May 1, 2005 through April 2010 is the abundance at the 2003 level.

Canadian Fisheries Variable - Depending on the management unit, Canadian fisheries on average, can account for the majority of the total fishery-related mortality (Table 4). The proportion of fishery-related mortality on individual populations within the ESU by Canadian fisheries has ranged from 4.5 percent for the population in the White River Management Unit to 75.7 percent for populations in the Nooksack Management Unit. The management of Canadian fisheries is outside the jurisdiction of the co-managers.

Table 4. The average distribution of fishery-related mortality for the management seasons 1996 to 2000, by management unit (Chinook Technical Committee (CTC) 2003). Canadian fisheries, on average, have accounted for over 50 percent of the fishery-related mortality in the Nooksack, Skagit Spring, Stillaguamish, and Elwha Management Units.

Management Unit	Alaska	British Columbia, Canada	Washington Troll	Puget Sound Net	Washington Recreational
Nooksack	1.6%	75.7%	1.5%	3.0%	18.3%
Skagit Summer/Fall [1]	2.3%	43.0%	1.8%	40.2%	12.7%
Skagit Spring	1.0%	51.4%	1.2%	7.1%	39.2%
Stillaguamish	17.8%	50.3%	0.3%	2.6%	29.1%
Snohomish	1.7%	23.2%	6.2%	54.8%	14.1%
Lake Washington	-	-	-	-	-
Green	2.1%	30.1%	9.4%	23.7%	37.7%
White	0.0%	4.5%	0.6%	3.5%	91.4%
Puyallup	-	-	-	-	-
Nisqually	0.5%	14.5%	2.6%	44.9%	37.6%
Skokomish	1.7%	37.4%	9.0%	7.2%	44.7%
Mid-Hood Canal	-	-	-	-	-
Dungeness	-	-	-	-	-
Elwha [2]	16.2%	58.8%	1.9%	0.8%	22.3%

[1] Samish River.
[2] The 1993 to 1997 average distribution of fishery-related mortality for the Elwha River was obtained from Table 3, page 185 of the RMP.

The level of Canadian fisheries is an important consideration in anticipating potential impacts into the future. In recent years, Canadian fisheries have not harvested chinook salmon at levels allowed under the Pacific Salmon Treaty due to internal Canadian conservation issues. These conservation concerns primarily pertain to depressed west coast Vancouver Island chinook salmon and Thompson River coho salmon populations (NMFS 2003a).

Under the implementation of the RMP, it is unclear if Canadian conservation actions will continue or if impacts will increase to maximum levels allowed under the Pacific Salmon Treaty. In modeling the Canadian fisheries, the impacts similar to fisheries in 2003 were used to represent the lower range of anticipated impacts. Maximum harvest levels allowed under the

Pacific Salmon Treaty were modeled to represent the upper range of impacts associated with Canadian fisheries. This proposed evaluation used the modeling based on the maximum harvest levels under the Pacific Salmon Treaty as the most likely to occur within this range. Table 5 provides the most likely exploitation rate and escapement numbers within modeled forecasts for Puget Sound chinook salmon by management unit or population under the RMP.

However, some caution must be exercised in using the results from this forecast modeling. For example, the 2003 fishery was used to model impacts for future fisheries. In 2003, the Skagit River chinook salmon return had an anomalously high estimated percentage of age-2 and age-3 fish. Age-2 and age-3 contribute little to natural spawning escapement in the Skagit River (B. Hayman, Skagit River System Cooperative, e-mail to S. Bishop, NMFS, January 28, 2004). Therefore, the estimated exploitation rate of 48 percent in 2003 is likely an overestimate of the actual exploitation rate experienced by the individual brood years present in that year. An exploitation rate of 36 percent is estimated for the individual brood years represented in 2003, 12 percentage points less than what was used in the modeling (B. Hayman, Skagit River System Cooperative, e-mail to S. Bishop, NMFS, January 28, 2004). In addition, 2003 was a high return year in the two-year pink salmon high-low abundance cycle. A higher exploitation rate on chinook salmon would be expected, when compared to low abundance pink salmon years. Incidental harvest of chinook salmon occurs in pink salmon directed fisheries.

Through forecast modeling, using 2003 as a base year, the anticipated range of the SUS exploitation rates is 16 to 18 percent for the Skagit Summer/Fall Management Unit (see Table 3). The actual SUS exploitation rates under the implementation of the RMP for the Skagit Summer/Fall Management Unit would most likely remain within what has been seen in recent years (B. Hayman, Skagit River System Cooperative, e-mail to S. Bishop, NMFS, January 28, 2004). The SUS exploitation rates on this management unit have ranged from 6 to 18 percent since 1999, with an average exploitation rate of 12 percent. The average exploitation rate of 12 percent is 4 percentage points less than the modeled exploitation rate assumed under the implementation of the RMP for the Skagit Summer/Fall Management Unit. Modeling results for this management unit, as depicted in Table 3 and Table 5, should be considered conservative, with the actual future exploitation rates likely less.

The co-managers will provide annual fishing-related mortality information as well as information on escapement for all populations identified in the RMP. The co-managers and NMFS will continue to evaluate the status and trends of populations, which may lead modification of the co-managers' proposed management of the fisheries.

Table 5. The most likely total exploitation rates, southern United States (SUS) exploitation rates, and escapements within the modeled forecasts under the implementation of the RMP by Puget Sound chinook salmon management unit or population.

Management Unit	Population	Anticipated Total Exploitation Rate	Anticipated SUS Exploitation Rate	Anticipated Pre-terminal SUS Exploitation Rate	Anticipated Escapement	Minimum Fisheries Regime Imposed [1]
Nooksack	Natural-Origin Spawner:	25%	7%	2 %	365	Yes
	North Fork Nooksack	-	-	-	164	
	South Fork Nooksack	-	-	-	201	
Skagit Summer/Fall [2]	Natural Spawners:	55%	16%	8%	11,029	Yes
	Upper Skagit River	-	-	-	9,258	
	Lower Sauk River	-	-	-	588	
	Lower Skagit River	-	-	-	1,182	
Skagit Spring	Natural Spawners:	27%	14%	13%	1,845	No
	Upper Sauk River	-	-	-	683	
	Suiattle River	-	-	-	621	
	Upper Cascade River	-	-	-	539	
Stillaguamish	Natural-Origin Spawners:	19%	11%	10%	2,281	No
	N.F. Stillaguamish River	-	-	-	1,860	
	S.F. Stillaguamish River	-	-	-	421	
Snohomish	Natural-Origin Spawners:	22%	13%	11%	4,901	Yes
	Skykomish River	-	-	-	2,385	
	Snoqualmie River	-	-	-	2,516	
Lake Washington	Natural Spawners:	35%	20%	10%	588	No
	Cedar River	-	-	-	294	
	Sammamish River	-	-	-	294	
Green	Natural Spawners:					
	Duwamish-Green River	63%	47%	10%	5,800 EG [3]	No
White	Natural Spawners:					
	White River	20%	18%	9%	1,459	No
Puyallup	Natural Spawners:					
	Puyallup River	50%	35%	10%	2,419	No
Nisqually	Natural Spawners:					

	Nisqually River	76%	65%	26%	1,100 EG [3]	No
Skokomish	Natural Spawners: Skokomish River	63%	44%	12%	1,200 EG [3]	Yes
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	32%	13%	12%	504	No
Dungeness	Natural Spawners: Dungeness River	27%	5%	4%	336	Yes
Elwha	Natural Spawners: Elwha River	27%	5%	4%	2,031	No

[1] A general description of these minimal fisheries, as proposed by the co-managers, is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

[2] Information presented is based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent rears, 6 to 18 percent exploitation rates.

[3] These management units are managed by the co-managers to achieve a natural spawner escapement goal or “EG.”

(3) Section (b)(4)(i)(A) Defines populations within affected Evolutionarily Significant Units, taking into account: spatial and temporal distribution, genetic and phenotypic diversity, and other appropriate identifiably unique biological and life history traits.

The TRT, in cooperation with the co-managers, has completed a preliminary analysis to identify populations of chinook salmon within the Puget Sound Chinook Salmon ESU (PSTRT 2003). The RMP's delineation of populations within the ESU is the same as those preliminarily recognized by the Puget Sound TRT. The TRT reviewed several sources of information in deriving the preliminarily recognized delineations. These sources of information include geography, migration rates, genetic attributes, patterns of life history and phenotypic characteristics, population dynamics, and environmental and habitat characteristics of potential populations (NMFS 2004b). The TRT has identified 22 demographically independent populations within the ESU, representing the primary historical spawning areas of chinook salmon (PSTRT 2003). The annual escapement of populations within the ESU since 1990 is provided in Table 6.

To assist the co-managers in analyzing the impacts of their management actions, the RMP categorizes each chinook salmon population according to the population's life history and production characteristics. The co-managers used this method to assign populations to one of three possible watershed based categories. A description of Category 1, Category 2, and Category 3 watersheds follows:

Category 1 - Category 1 watersheds are areas where populations are genetically unique and indigenous to Puget Sound. Maintaining genetic diversity and integrity, and achieving abundance levels for long-term sustainability are the highest priorities for these populations. The management objective for Category 1 populations is to protect and recover these indigenous populations. The intent is to rebuild and manage for natural production. The co-managers propose to manage fisheries to meet interim escapement goals and/or the rebuilding exploitation rates for Category 1 populations based on the co-managers' understanding of natural chinook salmon production requirements for each population. The co-managers designated 17 of the 22 populations within the ESU as Category 1 (Table 7).

The status of Category 1 populations within the ESU varies. Some populations have fallen to such low levels that the ability to maintain their genetic diversity may be at risk. In some cases, lacking hatchery operations, populations would likely decline to very low levels or go extinct. In one case at least, the number of hatchery-origin fish spawning naturally may be a concern, in part because it may be masking the ability to evaluate the actual productivity of the natural-origin population. Other populations are more robust and the abundance levels are above what is needed to sustain genetic diversity, but often not at levels that will sustain maximum yield.

Table 6. Natural-origin or natural escapement for Puget Sound chinook salmon populations, 1990 to 2002.

Management Unit	Population	1990	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Nooksack	Natural-Origin Spawner:	142	444	403	444	113	421	353	223	128	255	442	517	503
	North Fork Nooksack	6	87	345	285	26	175	210	121	39	91	159	250	221
	South Fork Nooksack	136	357	58	159	87	246	143	102	89	164	283	267	282
Skagit Summer/Fall	Natural Spawners:	16,792	5,824	7,348	5,801	5,549	6,877	10,613	4,872	14,609	4,924	16,930	13,793	19,591
	Upper Skagit River [1]	11,793	3,656	5,548	4,654	4,565	5,948	7,989	4,168	11,761	3,586	13,092	10,084	13,815
	Lower Sauk River [1]	1,294	658	469	205	100	263	1,103	295	460	295	576	1,103	910
	Lower Skagit River [1]	3,705	1,510	1,331	942	884	666	1,521	409	2,388	1,043	3,262	2,606	4,866
Skagit Spring	Natural Spawners:	1,511	1,346	986	783	470	855	1,051	1,041	1,086	471	906	1,856	1,065
	Upper Sauk River [1]	557	747	580	323	130	190	408	305	290	180	273	543	460
	Suiattle River [1]	685	464	201	292	167	440	435	428	473	208	360	688	265
	Upper Cascade River [1]	269	135	205	168	173	225	208	308	323	83	273	625	340
Stillaguamish	Natural-Origin Spawners:	701	1,279	716	725	743	654	935	839	863	767	1,127	936	1,090
	N.F. Stillaguamish River	434	978	422	380	456	431	684	613	615	514	884	653	737
	S.F. Stillaguamish River	267	301	294	345	287	223	251	226	248	253	243	283	353
Snohomish	Natural-Origin Spawners:	3,662	2,447	2,242	3,190	2,039	1,252	2,379	3,517	2,919	2,430	2,900	5,869	4,544
	Skykomish River	2,551	1,951	1,642	942	1,478	1,144	1,719	1,696	1,500	1,382	1,773	3,052	2,264
	Snoqualmie River	1,111	496	600	2,248	561	108	660	1,821	1,419	1,048	1,127	2,817	2,280
Lake Washington	Natural Spawners:	787	661	790	245	888	930	336	294	697	778	347	1,269	637
	Cedar River [1, 2]	469	508	525	156	452	681	303	227	432	241	120	810	369
	Sammamish River [3]	318	153	265	89	436	249	33	67	265	537	227	459	268
Green River	Natural Spawners:													
	Duwamish-Green River	7,035	10,548	5,267	2,476	4,078	7,939	6,026	9,967	7,300 [6]	9,100 [6]	6,170	7,975	13,950
White River	Natural Spawners:													
	White River	275	194	406	409	392	605	628	402	316	553	1,523	2,002	803
Puyallup	Natural Spawners:													
	Puyallup River [4]	3,515	1,702	3,034	1,999	1,328	2,344	2,111	1,110	1,711	1,988	1,193	1,915	1,590
	S. Prairie Creek Index Area [4]	-	-		-	798	1,408	1,268	667	1,028	1,430	695	1,154	840
Nisqually	Natural Spawners:													
	Nisqually River	994	953	106	1,655	1,730	817	606	340	834	1,399	1,253	1,079	1,542
Skokomish	Natural Spawners:													
	Skokomish River	642	1,719	825	960	657	1,398	995	452	1,177 [6]	1,692 [6]	926 [6]	1,913 [6]	1,479
Mid-Hood Canal	Natural Spawners													
	Mid-Hood Canal Rivers:	-	86	96	112	384	103	-	-	287	762	438	322	95
	Hamma Hamma River [5]	35	30	52	28	78	25	11	-	172	557	381	248	32
	Duckabush River [5]	10	14	3	17	9	2	13	-	57	151	28	29	20
	Dosewallips River [5]	1	42	41	67	297	76	-	-	58	54	29	45	43
Dungeness	Natural Spawners:													
	Dungeness River	310	163	158	43	65	163	183	50	110	75	218	453	633
Elwha	Natural Spawners:													

Elwha River [6, 7]	2,956	3,361	1,222	1,562	1,216	1,150	1,608	2,517	2,358	1,602	1,851	2,208	2,376
ESU Total	39,964	29,240	26,284	19,457	20,887	25,610	27,773	26,380	36,238	27,326	36,087	43,341	52,744

[1] The majority are natural-origin spawner.
[2] The escapement estimates for the Cedar River are based on an expansion of a live count of fish. However, Cedar River redd counts suggests that this expansion of the live count may be a conservative estimate of the total escapement (P. Hage, Muckleshoot Tribe, e-mail to S. Bishop, NMFS, February 10, 2004).
[3] Does not include escapement into the Upper Cottage Lake Creek, which has been surveyed since 1998. Surveys of the Upper Cottage Lake Creek have exceeded 100 fish (S. Foley, WDFW, pers. com., to K. Schultz, NMFS, February 19, 2004). Escapement counts also do not include spawners in Issaquah Creek, which are believed to be primarily Issaquah Hatchery returns (N. Sands, NMFS, e-mail to S. Bishop, NMFS, February 26, 2004). Therefore, escapement information presented is a conservative estimate of the total Sammamish River population’s escapement.
[4] The area surveyed for the South Prairie Creek index increased from 1.5 to 12.5 stream miles in 1994. Escapement results for 1994 to 2002 were provided by W. Beattie, Northwest Indian Fisheries Commission (NWIFC), on January 31, 2004.
[5] Escapement information obtained from the RMP.
[6] Escapement information provided by W. Beattie, NWIFC, on February 4, 2004.
[7] Escapement is considered in-river gross escapement plus hatchery voluntary escapement minus pre-spawning mortality.

Table 7. The RMP's assigned categories and run timing of the chinook salmon populations within the ESU.

RMP's Management Unit	RMP's Populations	RMP's Assigned Population Category	Run Timing
Nooksack	North Fork Nooksack River	1	Early
	South Fork Nooksack River	1	Early
Skagit Summer/Fall	Upper Skagit River	1	Summer
	Lower Sauk River	1	Summer
	Lower Skagit River	1	Fall
Skagit	Upper Sauk River	1	Spring
Spring	Suiattle River	1	Spring
	Upper Cascade River	1	Spring
Stillaguamish	North Fork Stillaguamish River	1	Summer
	South Fork Stillaguamish River	1	Fall
Snohomish	Skykomish River	1	Summer
	Snoqualmie River	1	Fall
Lake Washington	Cedar River	1	Fall
	Sammamish River	2	Fall
Green	Duwamish-Green River	1	Fall
White	White River	1	Spring
Puyallup	Puyallup River	2	Fall
Nisqually	Nisqually River	2	Fall
Skokomish	Skokomish River	2	Fall
Mid-Hood Canal	Mid-Hood Canal Rivers	2	Fall
Dungeness	Dungeness River	1	Summer
Elwha	Elwha River	1	Summer

Category 2 - Category 2 watersheds are areas where indigenous populations are believed to no longer exist, but where sustainable wild populations existed historically. The co-managers believe that self-sustaining natural production is possible in Category 2 watersheds given suitable or productive habitat. Five Category 2 populations within the ESU have been identified by the co-managers (Table 7).

Category 2 populations are primarily found in southern Puget Sound and Hood Canal where hatchery production has been used extensively to mitigate for natural production lost to habitat degradation. Historically, these areas were managed for hatchery production. Consequently, in many of these systems, hatchery and natural fish are currently indistinguishable on the spawning grounds. In the future, on-going mass marking programs implemented at regional hatcheries will provide a means to distinguish between hatchery-origin and natural-origin adult chinook salmon on the spawning grounds. Given degraded habitat conditions within these watersheds, the co-managers' goal of harvest management is to provide sufficient escapement to the spawning grounds to increase natural productivity. Future decisions regarding the form and timing of recovery efforts in these watersheds will dictate the kinds of harvest actions that may be necessary and appropriate.

The co-managers have assigned populations to Category 2 based on current information. Ongoing monitoring and studies may identify remnant indigenous populations, which if found, may cause the population to be reassigned to Category 1. Decisions by the TRT about roles of these populations in the ESU may also require the populations to be re-categorized. The RMP includes monitoring and evaluation elements that will assist the TRT in these decisions. Additionally, the co-managers recognize that there is ongoing work by the TRT and other resource agencies or organizations that may also affect future harvest actions.

Category 3 - Category 3 watersheds are where spawning chinook salmon are generally found in small tributaries that may now have some natural spawning, but never historically had independent, self-sustaining populations of chinook salmon. Chinook salmon in these watersheds are probably hatchery strays or progeny from hatchery strays. Consistent with the TRT guidance, these small tributary spawning aggregations characteristic of Category 3 watersheds do not meet the current definition of an independent population. Therefore, the TRT has not identified any populations in these watersheds as part of the Puget Sound chinook salmon ESU. Several Category 3 watersheds were identified in the 2001 RMP by the co-managers to characterize the chinook salmon spawning (PSIT and WDFW 2001). However, similar to the 2003 RMP (PSIT and WDFW 2003), the RMP does not identify or establish management objectives for any Category 3 watersheds, but focuses on Category 1 and Category 2 watersheds where the spawning aggregates meet the criteria for all of the extant independent populations identified by the TRT. NMFS' assessment only considers those populations the TRT has identified in the Puget Sound chinook salmon ESU (Category 1 and Category 2), and therefore will consider the effects of the proposed fisheries in Category 3 watersheds only to the extent they affect the populations identified by the TRT.

There are two main reasons why naturally spawning chinook salmon may not be designated as an independent population. First, spawning adults are known to occur intermittently in certain streams, spawning in the tens to hundreds in some years and none in others. A plausible biological explanation for intermittent occurrence of chinook salmon in some streams is that those adults are part of a larger independent population that uses the spawning habitat only during years of high abundance or favorable habitat conditions (NMFS 2004b). While these areas may not contain independent populations, the TRT may conclude that fish and habitat outside independent population boundaries may be important for the viability of the ESU (NMFS 2001). Second, in streams currently containing chinook salmon but which never historically supported naturally spawning chinook salmon, the natural spawning chinook salmon present may be of hatchery origin (NMFS 2004b). As additional information is gained in some of these systems, one or more populations may be identified and assigned to Category 1 or Category 2 by the co-managers.

In the RMP, the Nooksack, Skagit Summer/Fall, Skagit Spring, Stillaguamish, Snohomish, and Lake Washington Management Units include multiple populations. The co-managers aggregated populations within these management units for several reasons: (1) information is currently insufficient to derive population-specific objectives; (2) there is no information suggesting the populations are exploited unequally in mixed-population fisheries, and none of the populations have discrete extreme terminal areas where they could be harvested independently; (3) the populations have similar migration timing, catch distribution and productivity such that harvest objectives should also be similar; or (4) objectives have been derived for each population, and the management unit as a whole is managed to achieve the most constraining population objective. NMFS' evaluation took into consideration the adequacy of the RMP's population(s) structure of the management units in determining whether the RMP would not appreciably reduce the likelihood of survival and recovery of the ESU.

(4) Section (b)(4)(i)(B) Uses the concepts of ''viable'' and ''critical'' salmonid population thresholds, consistent with concepts in the Viable Salmonid Populations (VSP) paper (NMFS 2000b).

The regulations in the ESA 4(d) Rule require that the RMP must use the concepts of "viable" and "critical" thresholds in a manner so that fishery management actions: (1) recognize significant differences in risk associated with viable and critical population threshold states; and (2) respond accordingly to minimize long-term risks to population persistence. The RMP defines its own upper management and low abundance thresholds, but these are readily comparable to the viable and critical thresholds. Given considerations of actions in the other "Hs" (Habitat, Hatchery, and Hydropower), harvest actions that impact populations that are currently at or above their viable thresholds must maintain the population or management unit at or above that level. Fishing-related mortality on populations above critical levels but not at viable levels (as demonstrated with a high degree of confidence) must not appreciably slow rebuilding to viable function. Fishing-related mortality to populations functioning at or below their critical thresholds must not appreciably increase genetic and demographic risks facing the population and must be designed to permit achievement of viable functions, unless the RMP demonstrates the likelihood of survival and recovery of the entire ESU in the wild would not be appreciably reduced by greater risks to an individual population.

As required by the ESA 4(d) Rule, the harvest regime specified by the co-managers in the RMP takes into account the different risks facing a population depending on the status of the population: above the upper management threshold; below the upper management threshold but above a low abundance threshold, as defined by the RMP; or below the defined low abundance threshold. In most cases, the co-managers have set the low abundance threshold intentionally above what would be defined by the VSP paper as the critical threshold under current conditions.

After taking into account uncertainty, the critical threshold is defined as a point under current conditions below which: (1) depensatory processes are likely to reduce the population below replacement; (2) the population is at risk from inbreeding depression or fixation of deleterious mutations; or (3) productivity variation due to demographic stochasticity becomes a substantial source of risk (see page 15 of NMFS 2000b). A viable population is defined as: (1) a population large enough to have a high probability of surviving environmental variation of the patterns and magnitudes observed in the past and expected in the future; (2) a population with sufficient abundance for compensatory processes to provide resilience to environmental and anthropogenic perturbation; (3) a population sufficiently large to maintain its genetic diversity over the long term; and (4) a population sufficiently abundant to provide important ecological functions throughout its life-cycle (see page 14 of NMFS 2000b). Population status evaluations should take uncertainty regarding abundance into account.

However, viable and critical thresholds in the context of this evaluation are a level of spawning escapement associated with rebuilding to recovery, consistent with current environmental conditions. For most populations, these thresholds are well below the escapement levels associated with recovery, but achieving these goals under current conditions is a necessary step to eventual recovery when habitat and other conditions are more favorable. Survival and recovery of the Puget Sound Chinook Salmon ESU will depend, over the long term, on necessary actions in other sectors, especially habitat actions, and not on harvest actions alone. There is an on going recovery planning effort for the Puget Sound Chinook ESU. Completion of the recovery plan and decisions regarding the form and timing of recovery efforts described in the recovery plan will determine the kinds of harvest actions that may be necessary and appropriate in the future. Absent that guidance at the time of this writing, NMFS must evaluate the proposed harvest actions by examining the impacts of harvest within the current context. Therefore, NMFS has evaluated the future performance of populations in the ESU under recent productivity conditions; i.e., assuming that the impact of hatchery and habitat management actions remain as they are now.

NMFS has completed a comprehensive analysis to derive viable and critical thresholds for a subset of Puget Sound chinook salmon populations under current habitat and environmental conditions (Table 8). A more detailed description of the process NMFS used in deriving these population-specific viable and critical thresholds is presented in Appendix C: Technical Methods - Derivation of Chinook Management Objectives and Fishery Impact Modeling Methods of the environmental impact statement on the proposed determination of this RMP (Final Environmental Impact Statement (FEIS), Puget Sound Chinook Harvest Resource Management Plan). The NMFS-derived viable and critical thresholds were used to develop rebuilding exploitation rates for these same populations. NMFS developed the critical thresholds after consideration of genetic, demographic, and spatial risk factors for each population. NMFS' rebuilding exploitation rate was derived by using a simulation model to identify an exploitation rate that meets specific criteria related to both survival and recovery, given the specified thresholds and estimated spawner/recruit parameters (NMFS 2000a).

The simulation used the population-specific threshold levels to identify a rebuilding exploitation rate that met the following criteria: (a) Did the percentage of escapements less than the critical threshold value increase by less than five percentage points relative to the baseline *and either* (b) Does the escapement at the end of the 25-year simulation exceed the viable threshold at least 80 percent of the time *or* (c) Does the percentage of escapements less than the viable threshold at the end of the 25-year simulation differ from the no-fishing baseline by less than 10 percentage points. These criteria are similar, or identical, to the criteria used by the co-managers in developing several of the RMP's rebuilding exploitation rates. See Appendix C: Technical Methods - Derivation of Chinook Management Objectives and Fishery Impact Modeling Methods of the FEIS on the proposed determination for additional information on how NMFS developed its rebuilding exploitation rates (page 24 of the FEIS).

Table 8 compares the RMP's low abundance (lower) and upper management (upper) thresholds with the NMFS-derived critical (lower) and viable (upper) thresholds. For populations lacking the NMFS-derived critical and viable population thresholds, generic guidance from the VSP paper or available analyses of habitat capacity (such as using Ecosystems Diagnosis and

Treatment methodology) have been used to assist NMFS in evaluating the proposed RMP's thresholds.

Generic guidance from the VSP paper suggests that effective population sizes of less than 500 to 5,000 fish per generation are at increased risk (NMFS 2000b). The population size range per generation was converted to an annual spawner abundance range of 125 to 1,250 fish by dividing by four, which is the approximate generation length for Puget Sound chinook salmon. The VSP generic guidance for a critical threshold of 200 fish has been used to evaluate the RMP's proposed thresholds for populations lacking the NMFS-derived critical thresholds.

The VSP paper also suggests that effective population sizes of 5,000 to 16,700 fish are robust against most sources of risk (NMFS 2000b). Using the same average generation length of four years, the annual spawner range would be 1,250 to 4,175 spawners. Where the actual viable thresholds fall within these ranges depends on the characteristics of the populations themselves. The viable threshold of 1,250 fish, or when available, the analyses of habitat capacity have been used to evaluate populations lacking the NMFS-derived viable thresholds. The co-managers have completed several habitat studies for select systems within the ESU. These studies estimate the chinook salmon production potential of those systems under current conditions. When available, NMFS used the results from these studies to assess the risk of the thresholds in the RMP for those management units that lack the NMFS-derived viable thresholds.

These VSP-derived thresholds offer only general guidance as to what generally represents points of stability or instability. Some population may be fairly robust at very low abundances, while other populations in large river systems may become unstable at higher abundances depending on resource location and spawner density. However, without population-specific information, NMFS believes these generic guidelines offer the best available information.

The use of the threshold concept by the RMP is required by the ESA 4(d) Rule. A population will be identified in this proposed evaluation as having a potential increased level of risk[5] when the abundance of that population does not meet its critical threshold. In this evaluation, populations with abundance slightly above the critical threshold will also be highlighted and identified as of a population of concern. Additional discussion of the populations identified with an increased level of risk or concern, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

The trend in escapement was also considered in evaluating the population's status. In March 1999, the Puget Sound Chinook Salmon ESU was listed as a threatened species under the ESA. A general post-listing assessment of each population's escapement trend as either decreasing, remaining stable or increasing can be made by comparing the 1999 to 2002 average escapement with the 1990 to 1998 average escapement (Table 8). The following system was used to determine the trend of the populations:

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[5] When compared to populations at or above its critical threshold.

Increasing - The trend of a population was considered increasing if the difference in the 1999 to 2002 average escapement was greater than 10 percent above the pre-listing 1990 to 1998 average escapement;

Decreasing - The trend of a population was considered decreasing if the difference in the 1999 to 2002 average escapement was less than 10 percent below the pre-listing 1990 to 1998 average escapement; and

Stable - The trend of a population was considered stable if the difference in the 1999 to 2002 average escapement was within 10 percent the pre-listing 1990 to 1998 average escapement.

One of the criteria for Limit 6 of the ESA 4(d) Rule is that harvest actions that impact populations at or above their viable thresholds must maintain the population or management unit at or above that level (50 C.F.R. 223.203(b)(4)(i)(B)). Nine of the twenty-two Puget Sound Chinook Salmon ESU populations are above their respective viable thresholds (Table 9). Based on the method described above, all populations above their respective viable thresholds have a stable (two populations) to increasing (seven populations) trend in escapement (Table 9). Overall, along with other on-going habitat and hatchery programs, the results of harvest actions since the ESA listing of the Puget Sound Chinook Salmon ESU appears to be maintaining these populations above the viable threshold levels as required by the ESA 4(d) Rule.

Another criterion for Limit 6 of the ESA 4(d) Rule is that fishing-related mortality on populations above critical levels, but not at viable levels (as demonstrated with a high degree of confidence), must not appreciably slow achievement to viable function. Twelve populations are above their respective critical levels, but below their respective viable levels (Table 9). Of these, four populations have a stable escapement trend and eight populations have an increasing escapement trend (Table 9). Overall, along with other on-going habitat and hatchery programs, the results of harvest actions since the ESA listing of the Puget Sound Chinook Salmon ESU appears to have not appreciably slowed achievement to viable function for these populations, as required by the ESA 4(d) Rule.

The criterion for populations at or below their critical thresholds is that fishing-related mortality on the population must not appreciably increase genetic and demographic risks facing the population, and does not preclude achievement of viable functions, unless the RMP demonstrates the likelihood of survival and recovery of the entire ESU in the wild would not be appreciably reduced by greater risks to an individual population. Only one population in the ESU, the North Fork Nooksack River population, is considered to be below its critical threshold (Table 9). A discussion concerning the status of the North Fork Nooksack River population follows.

North Fork Nooksack River Population - The 1999 to 2002 four-year average natural-origin spawning escapement for the North Fork Nooksack River population, which includes the Middle Fork Nooksack River, is 180 fish. The four-year average abundance of the North Fork Nooksack River population falls below the NMFS-derived critical threshold of 200 fish. The North Fork Nooksack River natural-origin population has an increasing escapement trend since listing (Table 9).

Table 8. Recent average annual escapement levels compared with the RMP's and the NMFS-derived lower and upper thresholds for Puget Sound chinook salmon management units and individual populations.

Management Unit	Population	1990 to 1998 Average Escapement	1999 to 2002 Average Escapement	RMP's Threshold Lower	RMP's Threshold Upper	NMFS-derived Thresholds Lower [1]	NMFS-derived Thresholds Upper [2]
Nooksack	Natural-Origin Spawner:	297	429	-	*4,000*	*400*	*500*
	North Fork Nooksack	144	180	*1,000*	*2,000*	*200*	-
	South Fork Nooksack	153	249	*1,000*	*2,000*	*200*	-
Skagit Summer/Fall	Natural Spawners:	8,698	13,810	*4,800*	*14,500*	-	-
	Upper Skagit River	6,676	10,144	*2,200*	*8,434*	*967*	*7,454*
	Lower Sauk River	539	721	*400*	*1,926*	*200*	*681*
	Lower Skagit River	1,484	2,944	*900*	*4,140*	*251*	*2,182*
Skagit Spring	Natural Spawners:	1,014	1,075	*576*	*2,000*	-	-
	Upper Sauk River	392	364	*130*	*986*	*130*	*330*
	Suiattle River	398	380	*170*	*574*	*170*	*400*
	Upper Cascade River	224	330	*170*	*440*	*170*	-
Stillaguamish	Natural-Origin Spawners:	828	980	*650*	*900*	-	-
	N.F. Stillaguamish River	557	697	*500*	*600*	*300*	*552*
	S.F. Stillaguamish River	271	283	-	*300*	*200*	*300*
Snohomish	Natural-Origin Spawners:	2,627	3,936	*2,800*	*4,600*	-	-
	Skykomish River	1,625	2,118	*1,745*	*3,600*	*1,650*	*3,500*
	Snoqualmie River	1,003	1,818	*521*	*1,000*	*400*	-
Lake Washington	Natural Spawners:	624	767	-	-	-	-
	Cedar River	417	385	*200*	*1,200*	-	-
	Sammamish River	208	373	-	-	-	-
Green River	Natural Spawners:						
	Duwamish-Green River	6,737	9,299	*1,800*	*5,800*	*835*	*5,523*
White River	Natural Spawners:						
	White River	403	1,220	*200*	*1,000*	-	-
Puyallup	Natural Spawners:						
	Puyallup River	2,173	1,672	*500*	-	-	-
	South Prairie Cr. Index Area	1,032	1,029	-	*500*		
Nisqually	Natural Spawners:						
	Nisqually River	893	1,318	-	*1,100*	-	-
Skokomish	Natural Spawners:						
	Skokomish River	981	1,503	*1,300* [3]	*3,650* [4]	-	-
Mid-Hood Canal	Natural Spawners:						
	Mid-Hood Canal Rivers	178	404	*400*	*750*	-	-
Dungeness	Natural Spawners:						
	Dungeness River	138	345	*500*	*925*	-	-
Elwha	Natural Spawners:						
	Elwha River	1,994	2,009	*1,000*	*2,900*	-	-

[1] Critical threshold under current habitat and environmental conditions.
[2] Viable thresholds under current habitat and environmental conditions
[3] Skokomish Management Unit's critical escapement threshold of 1,300 spawners is composed of 800 natural-origin spawners and 500 hatchery-return spawners.
[4] Skokomish Management Unit's escapement goal of 3,650 spawners is composed of 1,650 natural-origin spawners and 2,000 hatchery-return spawners. If the recruit abundance is insufficient for the goal to be met, OR regardless of the total escapement, the naturally spawning component of the Skokomish River population is expected to fall below 1,200 spawners, *or* the hatchery component is expected to result in less than 1,000 spawners, additional terminal fishery management measures will be taken, with the objective of meeting or exceeding the 1,200 naturally spawning levels (see page 175 of the RMP).

Table 9. Post-listing threshold classification and escapement trend since listing for Puget Sound chinook salmon populations.

Classification [1]	Management Unit	Population	Percent Difference Since Listing [2]	Trend Since Listing [3]
Since listing, the average escapement is above the upper threshold:	Skagit Summer/Fall:	Upper Skagit River	52%	Increasing
		Lower Sauk River	34%	Increasing
		Lower Skagit River	98%	Increasing
	Skagit Spring	Upper Sauk River	-7%	Stable
	Stillaguamish	N.F. Stillaguamish River [4]	25%	Increasing
	Snohomish	Snoqualmie River [4]	81%	Increasing
	Green River	Duwamish-Green River	38%	Increasing
	Puyallup	Puyallup River S. Prairie Creek Index Area [5]	0%	Stable
	Nisqually	Nisqually River	48%	Increasing
Since listing, the average escapement is above the lower threshold but below the upper threshold:	Nooksack	S. F. Nooksack River [4]	63%	Increasing
	Skagit Spring:	Suiattle River	-5%	Stable
		Upper Cascade River	48%	Increasing
	Stillaguamish	S.F. Stillaguamish River [4]	5%	Stable
	Snohomish	Skykomish River [4]	30%	Increasing
	Lake Washington:	Cedar River	-8%	Stable
		Sammamish River	79%	Increasing
	White River	White River	203%	Increasing
	Skokomish	Skokomish River: Natural Spawners	53%	Increasing
	Mid-Hood Canal	Mid-Hood Canal Rivers	127%	Increasing
	Dungeness	Dungeness River	149%	Increasing
	Elwha	Elwha River	1%	Stable
Since listing, the average escapement is below the lower threshold:	Nooksack	N. F. Nooksack River [4]	25%	Increasing

[1] The thresholds used in the classification were either the NMFS-derived critical and viable population thresholds under current conditions or thresholds derived using the VSP guidance for critical and viable levels.
[2] The percent difference in the post-listing 1999 to 2002 average escapement when compared to the pre-listing 1990 to 1998 average escapement.
[3] The trend of a population was considered increasing if the 1999 to 2002 average escapement was 10 percent or greater than the 1990 to 1998 average escapement. The trend of a population was considered decreasing if the 1999 to 2002 average escapement was 10 percent or less than the 1990 to 1998 average escapement. The trend of a population was considered stable if the 1999 to 2002 average escapement was within 10 percent of the 1990 to 1998 average escapement.

Footnote to Table 9 continued:

[4] Natural-origin spawners.
[5] NMFS assumed that the escapement trend for the South Prairie Creek and Wilkeson Creek (jointly referred to as the South Prairie index area) are representative of the escapement trend for the entire Puyallup River population. It is believed that the South Prairie index area provides a more accurate trend in the escapement for the Puyallup River because it is the only area in the Puyallup River for which spawners or redds can be consistently counted (W. Beattie, NWIFC, e-mail to K. Schultz, NMFS, January 31, 2004). Additionally, available information suggests that South Prairie Creek contains the highest quality spawning habitat in the system. Confidence in the South Prairie index area escapement estimates improved when the area surveyed increased from 1.5 to 12.5 stream miles in 1994. Surveys consistently identified substantial numbers of spawners in the mainstem Puyallup River, Carbon Creek, and other tributaries. However, total escapement estimates into the Puyallup River system is considered unreliable at this time.

Chinook salmon produced through the Kendall Creek Hatchery program, located on the North Fork Nooksack River, is also listed under the ESA, as they were considered essential for the recovery of the ESU. Production from Kendall Creek Hatchery contributes extensively to the annual return abundance of the North Fork Nooksack River population. If escapement of the hatchery-origin fish to the natural spawning grounds is considered, the 1999 to 2002 four-year average spawning escapement is 3,438 fish for the North Fork Nooksack River (Table 10).

Table 10. Natural-origin and natural spawners, North Fork Nooksack River, 1999 to 2002.

Management Unit	North Fork Nooksack River Population	1999	2000	2001	2002	1999 to 2002 Average
Nooksack	Natural-Origin Spawners:	91	159	250	221	180
	Natural Spawners [1]	911	1,365	4,057	7,419	3,438

[1] Natural spawners include first generation hatchery-origin adults that spawn in natural spawning areas.

Genetic analysis of natural origin and Kendall Creek Hatchery-origin spring chinook salmon indicate that there are no significant differences between the natural and hatchery populations, and that they are one distinct stock (Young and Shaklee 2002). Additionally, the co-managers are applying operational techniques that decrease the likelihood for divergence of the hatchery population from the extant natural population. Adult fish production resulting from the Kendall Creek hatchery program buffers genetic and demographic risks to the North Fork Nooksack River population. Therefore, at this time, NMFS concludes that the RMP does not appreciably increase genetic and demographic risks facing this population, as required by the ESA 4(d) Rule, for a population below their critical level. Discussion of this population's status, in regards to the likelihood of survival and recovery of the ESU, is in the Section (b)(4)(i)(D).

In addition to the discussions of the status of the populations, the ESA 4(d) Rule requires a risk analysis of the populations under the implementation of the RMP. The VSP document (NMFS 2000b) describes four key parameters for evaluating the status of salmonid populations. These parameters are: (1) population size (abundance); (2) population growth rate (productivity); (3) spatial structure; and (4) diversity. Below is an evaluation of how the RMP addresses these four VSP parameters for the Puget Sound Chinook Salmon ESU.

(1) Population Size

To analyze risks posed by the RMP on Puget Sound chinook salmon population's size or abundance, anticipated escapement results under the implementation of the RMP are compared with NMFS' standards of a critical (lower) and viable (upper) thresholds.

Lower Thresholds:

Table 2 provides the proposed RMP's low abundance thresholds. NMFS has derived critical thresholds for 13 populations. The NMFS-derived critical thresholds ranged from 170 to 1,650 fish (see Table 8). For those populations for which the RMP identifies a corresponding low abundance threshold, the RMP's thresholds are either the same, or more commonly, greater than the NMFS-derived population-specific critical thresholds. For these populations with NMFS-derived critical thresholds, the corresponding RMP's proposed low abundance thresholds are consistent with NMFS' standards.

There are nine populations for which NMFS has yet to derive a critical threshold (see Table 8). The proposed RMP's low abundance thresholds for these nine populations exceed the minimum VSP generic guidance of 200 annual spawners. For these nine populations, the RMP's proposed low abundance thresholds are consistent with the VSP guidance for a critical threshold.

However, for two populations, the RMP does not propose a low abundance threshold to use in a comparison with NMFS' standards. For the Stillaguamish Management Unit, NMFS has derived a critical threshold for both populations. The RMP did not establish a low abundance threshold for one of these populations, the South Fork Stillaguamish River population (see Table 8). The RMP also provides no low abundance threshold for the Sammamish River population (see Table 2). The following is a risk analysis associated with the lack of a low abundance threshold in the RMP for the South Fork Stillaguamish River and Sammamish River populations.

South Fork Stillaguamish River - The Stillaguamish Management Unit includes two populations: the North Fork Stillaguamish River and the South Fork Stillaguamish River populations. Both populations are classified as a Category 1 watershed population (see Table 7). The RMP establishes a low abundance threshold for the Stillaguamish Management Unit of 650 fish, and a low abundance threshold for the North Fork Stillaguamish River population of 500 fish (see Table 2). Both low abundance thresholds are based on natural-origin spawners. However, the RMP provides no low abundance threshold for the South Fork Stillaguamish River population, citing that there is very little information concerning the productivity of this population (page 134 of the RMP).

The 1999 to 2002 four-year average of 697 fish for the North Fork Stillaguamish River population is above the NMFS-derived viable threshold (see Table 8). Since listing, the escapement trend of the North Fork Stillaguamish River population is considered increasing (see Table 9). The escapement trend for the South Fork Stillaguamish River population is considered stable (see Table 9). The 1999 to 2002 four-year average of 283 fish for the South Fork Stillaguamish River population is above the NMFS-derived critical threshold of 200 fish but below the NMFS-derived viable threshold of 300 fish (see Table 8).

Recent (1999 to 2002) natural-origin escapement observations for these two systems were used to estimate the South Fork Stillaguamish River population escapement when the population nears the management unit's proposed low abundance threshold of 650 fish. On average, escapement into the South Fork Stillaguamish River was 28.9 percent of the total natural-origin escapement in the Stillaguamish River (Table 11). At natural-origin escapements approaching the RMP's low abundance threshold of 650 natural-origin fish for this management unit, assuming similar proportions to recent escapement observations, the natural-origin escapement into to the South Fork Stillaguamish River population would be 188 fish (28.9 percent of 650).

Table 11. Recent range and average natural-origin escapements for the two populations within the Stillaguamish Management Unit.

	1999 to 2002 Escapement		
Population:	Range	Average	Percent
N. F. Stillaguamish River	514 to 884	697	71.1%
S. F. Stillaguamish River	253 to 353	283	28.9%
Total		980	100%

An escapement of 188 fish is slightly below the NMFS-derived critical threshold of 200 fish for the South Fork Stillaguamish River population, suggesting a potential elevated level of risk for South Fork Stillaguamish River population under the implementation of the RMP. However, this potential elevated level of risk would only occur when the returning abundance approaches the RMP's low abundance threshold of 650 fish for this management unit. Actual impacts on the South Fork Stillaguamish River population, associated with the implementation of the RMP, will depend on the returning abundance in the next five years, from May 1, 2005 through April 2010, the remaining duration of the proposed RMP.

The anticipated returns to the Stillaguamish Management Unit are well above the 650 fish RMP's low abundance threshold. The range of anticipated escapements to the Stillaguamish Management Unit under the implementation of the RMP is 1,584 to 2,322 fish. The range of anticipated escapements to the South Fork Stillaguamish River population under the implementation of the RMP is 293 to 429 fish (see Appendix A of this evaluation). The most likely South Fork Stillaguamish River escapement under the implementation of the RMP is 421 fish (see Table 5). The most likely escapement to the South Fork Stillaguamish River exceeds the NMFS-derived viable threshold of 300 fish. Therefore, it is unlikely the level of risk to the South Fork Stillaguamish River population will increase in the next five years, from May 1, 2005 through April 2010, when compared to NMFS' standards, resulting directly from the lack of a low abundance threshold in the RMP.

Sammamish River - The Lake Washington Management Unit contains two chinook salmon populations; the Cedar River (Category 1) and the Sammamish River (Category 2) populations (see Table 7). The RMP's low abundance threshold for the Cedar River population is 200 chinook salmon. Total escapement estimates for the Cedar River population are based on an expansion of a live count of fish. However, Cedar River redd counts suggests that this expansion of the live count may be a conservative estimate of the total escapement (P. Hage, Muckleshoot Tribe, e-mail to S. Bishop, NMFS, February 10, 2004). Therefore, a direct comparison of Cedar

River escapements, based on an expansion of a live count, with the VSP generic guidance for a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

The RMP contains no low abundance thresholds for the Sammamish River population. The status of Sammamish River population natural production is not well understood. The contribution of non-listed hatchery-origin chinook salmon to the natural spawning escapement in the Sammamish River has not been quantified in the past, although mass marking of Issaquah Creek Hatchery production will enable this in the future (W. Beattie, NWIFC, e-mail to K. Schultz, NMFS, January 31, 2004). However, as evidenced by its Category 2 classification, hatchery contribution to the Sammamish River population is believed to be high. Since listing, the trend for the Sammamish River population's escapement is considered increasing (see Table 9).

Escapement estimates presented in Table 6 for the Sammamish River population do not include escapement into the Upper Cottage Lake Creek. The Upper Cottage Lake Creek has only been surveyed since 1998, preventing a longer term trend analysis. Annual salmon count surveys of the Upper Cottage Lake Creek have exceeded 200 fish in recent years (see Table 2, page 154 of the RMP). Additionally, Sammamish River escapement counts presented in Table 6 do not include spawners in Issaquah Creek, which are believed to be primarily Issaquah Hatchery returns (N. Sands, NMFS, e-mail to S. Bishop, NMFS, February 26, 2004). Therefore, although the escapement information present in Table 6 is believed to be representative of this population's abundance trend, the escapement estimates are to be considered a minimum estimate of the total Sammamish River population's escapement. As with the Cedar River population, a direct comparison of Sammamish River escapements with the VSP generic guidance for a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

The range of anticipated escapements to the Sammamish River under the implementation of the RMP is 214 to 305 fish (see Table 3). These estimates are based upon the spawner index database, and since that database represents a minimum estimate, and excludes fish in tributaries and reaches that are not included in the index, these estimates are assumed to be minimums. The most likely escapement for the Sammamish River population under the implementation of the RMP is a minimum of 294 fish (see Table 5). The most likely escapement for the Sammamish River population is above the VSP guidance of 200 fish for a critical threshold. Concerns do exist for this population, given that the range of anticipated escapements approaches the VSP-derived critical threshold. However, it is recognized that the actual total escapements into these systems will probably be greater given the conservative nature of the estimates. Additional discussion of the increased concern for this population's status, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

Upper Thresholds:

The RMP's upper management thresholds for the various management units or populations range from 300 to 14,500 fish (see Table 2). NMFS has independently derived viable thresholds for nine individual populations and one management unit ranging from 300 to 7,454 fish (see Table

8). NMFS used the RMP's upper management thresholds as a proxy for viable thresholds. For those populations for which the RMP identifies a corresponding upper management threshold, the RMP's thresholds are the same, or more commonly, greater than the NMFS-derived viable thresholds. For these populations, the RMP's upper management thresholds are consistent with NMFS' standards.

For populations which NMFS has yet to derive a viable threshold, the proposed RMP's upper management threshold exceeds the VSP generic guidance for a viable population of 1,250 fish for three populations (Cedar River[6], Skokomish River, and Elwha River). For these three populations, the levels of risk associated with the implementation of the proposed upper management thresholds are consistent with NMFS' standards.

For five populations without NMFS-derived viable thresholds (upper Cascade River, Snoqualmie River, White River, Nisqually River, and the Dungeness River), the proposed RMP's upper management threshold is less than a viable threshold that would be established using the VSP generic guidance. However, the RMP's upper management threshold for each of these populations is based on habitat studies or modeling results which suggests that each proposed threshold is consistent with the current capacity and productivity of the system. For these five populations, the levels of risk associated with the implementation of the proposed upper management thresholds are consistent with NMFS' standards.

For two of the remaining three populations without NMFS-derived viable thresholds (Sammamish River and Mid-Hood Canal rivers populations), the ranges of anticipated escapements over the next five years, from May 1, 2005 through April 2010, are very low, well below the proposed RMP's upper management threshold. Escapement levels are not expected to exceed the proposed upper management threshold under the implementation of the RMP (see Table 5 and Table 8). Therefore, it is unlikely that an elevated level of risk from harvest impacts on these two populations will result directly from the implementation of the proposed upper management thresholds in the RMP. However, the low levels of anticipated escapements for these two populations do raise concerns, which will be addressed later in this document.

The RMP proposes an upper management threshold of 500 fish for the remaining population without a NMFS-derived viable threshold, the Puyallup River population. The co-managers' threshold is based on escapement levels for the South Prairie Creek index area. The co-managers propose that by achieving an escapement to South Prairie Creek index area of at least 500 fish, viable natural production for the entire system would be assured (see page 166 of the RMP). The anticipated range of escapements to the Puyallup River under the implementation of the RMP is 1,798 to 2,419 fish (see Table 3). Since the entire range of anticipated escapements exceeds the VSP generic guidance of 1,250 fish, the level of risk for the Puyallup River population associated with the implementation of the proposed RMP's upper management thresholds are consistent with NMFS' standards.

[6] Given the conservative nature of the Cedar River escapement estimates, the RMP's upper management threshold of 1,200 fish for this population is considered to meet the VSP guidance of 1,250.

In summary of the upper management thresholds proposed by the co-managers in the RMP, most Puget Sound chinook salmon populations meet or exceed the NMFS-derived or VSP-derived viable thresholds. For several populations, the anticipated abundance levels over the next five years, from May 1, 2005 through April 2010, make the application of the RMP's upper thresholds very unlikely. Therefore the levels of risk associated under the implementation of the RMP's upper management thresholds are consistent with NMFS' standards.

(2) Productivity

Harvest management objectives must be appropriate for the habitat capacity and productivity requirements of individual populations. The RMP provides no explicit management objectives for productivity. The exploitation rates, upper management thresholds, escapement goals, and the low abundance thresholds are based, when feasible, on current survival and productivity rates, with adjustments to account for data uncertainty and management imprecision.

Productivity is generally understood to be the ratio of the abundance of juvenile or adult produced in one generation to the abundance of their parent spawners. Productivity is primarily driven by habitat quantity, quality, and reproductive fitness. All watersheds in Puget Sound have degraded habitat from a variety of causes, including logging, road building, agriculture, urbanization, flood control and hydropower. The degree to which each of these causes contributes to the decline in habitat quality or quantity varies from watershed to watershed.

Another aspect of habitat quality is the level of marine-derived nutrients introduced into an ecosystem by eggs deposited by spawning salmon and by decaying salmon carcasses. This can be influenced in part, by fisheries, since they will have a negative effect on escapement. The RMP addresses the role of adult salmon in nutrient re-cycling in Appendix D: Role of Salmon in Nutrient Enrichment of Fluvial Systems of the RMP. Marine-derived nutrients are a source of food for juvenile salmonids, invertebrates, and provide basic nutrients to the ecosystems (Larkin and Slaney 1996; Gresh *et al.* 2000; Murota 2003; Wipfli *et al.* 1998). However, nutrient dynamics in aquatic systems is very complex (Polis *et al.* 1997; Bisson and Bilby 1998; Murphy 1998; Naiman *et al*. 2000). The importance of salmon nutrient re-cycling within a given aquatic ecosystem remains very poorly understood and is dependent on numerous site-specific factors. These factors include: the species of salmon; spawning density; spawning location; stream discharge regimes in the area; stream habitat complexity; basin geology; light; temperature; and ecosystem community structure.

The role of returning adult chinook salmon as a means of re-cycling nutrients into a freshwater ecosystem must be examined in the context of the limitations of current research on the subject, chinook salmon life history, and chinook salmon abundance relative to the generally more abundant escapement of coho salmon (*Oncorhynchus kisutch)*, pink salmon (*O. gorbuscha*), and chum salmon (*O. keta*) in the larger river systems that typically support the Puget Sound chinook salmon populations. Additionally, while the limited available research suggests that salmon-derived nutrients can benefit coho salmon, sockeye salmon (*O. nerka*), and cutthroat trout (*O. clarki*) populations, data and technical tools establishing or quantifying the relationship between marine-derived nutrients and chinook salmon are not available.

Chinook salmon populations in Puget Sound typically exhibit a relatively short freshwater residence, at least when compared with coho salmon, sockeye salmon, and steelhead. It is not known if newly emerged chinook salmon fry actively feed on chinook salmon carcasses, or if chinook salmon carcasses are retained for a sufficient period in the freshwater ecosystem to allow direct consumption by emerging fry, especially in the larger river systems which support chinook salmon. The larger river systems in the action area generally exhibit peak winter flow events which may flush the chinook salmon carcasses from the freshwater ecosystem prior to the emergence of juvenile chinook salmon.

The benefits of marine derived nutrients for juvenile chinook salmon may be more fully realized in estuaries (Simenstad 1997), where most chinook salmon rear for a critical period prior to migrating seaward. However, even less is known about the role of marine-derived nutrients in estuaries. Consequently, it has not been demonstrated that carcass nutrient limitation, as it may affect secondary production of prey species or direct enhancement of food supply, currently exerts a key limit on the productivity of chinook salmon in the Puget Sound Action Area.

The co-managers propose to continue monitoring and the evaluation of the fisheries as required in the RMP. Based on information they obtain and that may be provided by other resource managers, the co-managers may revise the management objective in future plans, reflecting changes in environmental conditions and scientific understanding of carcass nutrient limitation. The intent of the co-managers is to increase spawning escapement in concert with the recovery of the system's productivity and capacity resulting from habitat restoration efforts. Under this approach, the co-managers will annually provide sufficient escapement to enable each management unit to generate maximum surplus under progressively improving habitat conditions. The RMP's harvest strategy will complement concurrent efforts to restore and protect habitat, improve hatchery management practices, and mitigate the impacts of hydroelectric operations. In addition, spawner recruit functions used to derive many of the RMP's objectives express the impacts of all the factors that influence productivity, including nutrient input. However, changes in productivity will be exceedingly difficult to attribute to changes in nutrient input relative to other environmental responses.

Natural Factors

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. For example, large scale climatic regimes, such as El Niño, affect changes in ocean productivity. Much of the Pacific coast was subject to a series of very dry years during the first part of the 1990s. In more recent years, severe flooding has adversely affected some stocks.

Salmon are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that rebounding seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids.

Recent evidence suggests that marine survival of salmon species fluctuates in response to 20 to 30 year long periods of either above or below average survival that is driven by long-term cycles of climatic conditions and ocean productivity (Cramer *et al.* 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation (Mantua *et al.* 1997). Ocean conditions that affect the productivity of Puget Sound salmonid populations appear to have been an important contributor to the decline of many stocks prior to listing. Ocean conditions appear to have improved in recent years, which may have contributed to the increase in abundance of Puget Sound salmonid populations since listing. However, NMFS does not have data to corroborate an improved marine survival trend for Puget Sound populations at this time. The survival and recovery of these species will depend on their ability to persist through periods of low ocean survival when stocks may depend on better quality freshwater habitat and lower relative harvest rates.

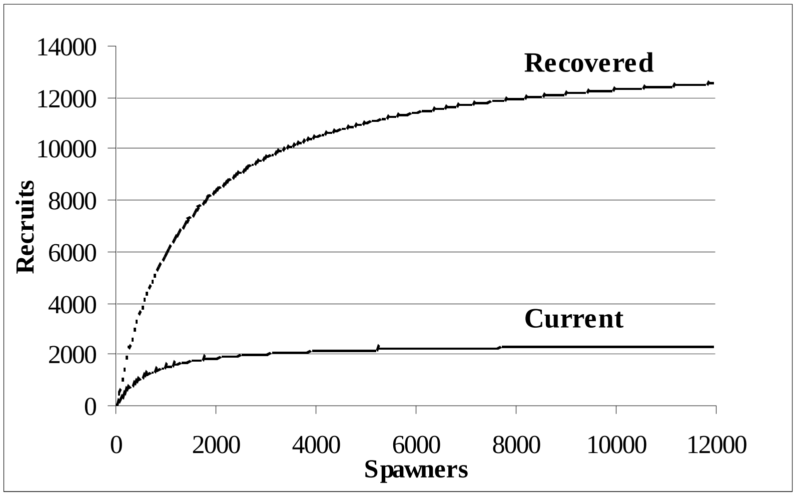
Performance under Current Habitat and Environmental Conditions:

The survival and recovery of the Puget Sound Chinook Salmon ESU will depend, over the long term, on responses to limiting factors, including those associated with hatchery and habitat. Completion of the ESU recovery plan and decisions regarding the form and timing of recovery efforts described in the recovery plan is ongoing, but will determine the kinds of harvest actions that may be necessary and appropriate in the future. Absent guidance provided in a recovery plan, NMFS evaluated the RMP by examining the isolated impacts of harvest on the ESU under current conditions. Therefore, this document evaluates the future performance of the population under current productivity conditions, assuming that the impacts of the hatchery and habitat actions remain as they are presently.

Though the Puget Sound TRT has not specifically determined what is needed for recovery of the Puget Sound Chinook Salmon ESU, the TRT have derived preliminary recovery goals for most populations (NMFS 2002a). The TRT's preliminary recovery goals can provide a useful contrast between current productivity and the level of potential productivity associated with recovery. For most Puget Sound chinook salmon populations, recovery is dependent on an increase in productivity (recruitment) relative to current status, not simply achieving the optimum escapement levels associated with current habitat conditions. Past harvest constraints have contributed to stable or increasing trends in escapements, which for several populations include hatchery-origin adults. However, the trend in natural-origin returns, when compared with hatchery returns, into several systems suggests that marine, freshwater, and estuary habitat quality and quantity is the primary constraint on productivity. Spawner-recruit functions derived from Ecosystems Diagnostics and Treatment or EDT [7] modeling of habitat capacity under current

[7] The Ecosystems Diagnostics and Treatment or EDT model provides a conceptual framework for organizing information to describe a watershed ecosystem in order to apply scientific principles to the understanding of that ecosystem. The model describes how the fish population would respond to conditions in a stream based on our scientific understanding of their needs. It is an analytical tool used to analyze environmental information and draw conclusions about the ecosystem, and designed to provide a practical, science-based approach for developing and implementing watershed plans. EDT models have been used to develop fish and wildlife plans for many watersheds throughout the Pacific Northwest.

and recovered conditions demonstrates that natural production is constrained below that associated with a recovered habitat condition (Figure 3).



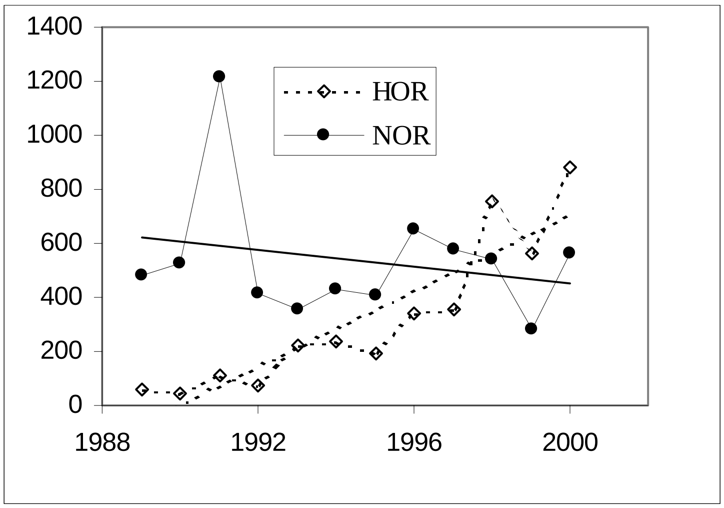
Source: T. Scott, WDFW, March 22, 2004.

Figure 3 Productivity (adult recruits) of North Fork Stillaguamish summer chinook salmon under current and recovered habitat conditions. Beverton-Holt functions derived from habitat analysis using the Ecosystems Diagnostics and Treatment or EDT method.

Further harvest constraint will not, by itself, effect an increase above the asymptote associated with current productivity, until habitat conditions improve. Very similar conclusions can be drawn from examination of current natural-origin escapement trends in the North Fork Nooksack, Skykomish, and Dungeness rivers. In these systems, natural-origin returns have remained at very low levels, while total natural escapement has increased due to hatchery supplementation programs.

In making an evaluation of future escapement performance under current productivity conditions, it would be useful to examine recent escapement trends in relation to past reductions in harvest rates. Mass marking of hatchery production has enabled managers to begin accurate accounting of the contribution of natural-origin and hatchery-origin spawners to the natural escapement for several Puget Sound chinook salmon populations (see Chapter 6 of the RMP and Appendix A: Management Unit Status Profiles of the RMP). Sufficient data has accumulated to conclude that reductions in harvest rates, along with more favorable conditions for marine survival, have contributed to an increasing trend in hatchery-origin returns. In some systems the harvest rates have been reduced by 30 to 70 percent from the mid-1980s. However, the returns of natural-origin fish in those same systems have not responded similarly. This evidence suggests that, in some systems, natural production is constrained primarily by the condition of the marine, freshwater, and estuary habitat.

The population trend for the North Fork Stillaguamish River is cited here as an example, although, similar escapement data is available for the populations within the North Fork Nooksack and Skykomish Rivers. Fingerlings released by the summer chinook salmon supplementation program are coded wire tagged, enabling accurate estimation of their contribution to escapement. The 2001 to 2003 three-year average total, adult-equivalent exploitation rate for the Stillaguamish Management Unit of 15 percent has declined 71 percent when compared with the 1983 to 1987 five-year average total, adult-equivalent exploitation rate of 54 percent (see Table 13, page 47, of the RMP). Although the return of hatchery-origin chinook salmon appear to have responded to this decrease in exploitation rate, exceeding 800 since 1989, the natural-origin returns have remained relatively stable in the last five years, averaging 522 fish (Figure 4). Hatchery production since 1989 has been relatively constant (T. Tynan, NMFS, pers. com., to K. Schultz, NMFS, March 25, 2004).



Source: T. Scott, WDFW, March 22, 2004.

Figure 4. The return of natural-origin (NOR) chinook salmon to the North Fork Stillaguamish River has remained relatively stable, while the number of hatchery-origin adults (HOR) have increased substantially.

Harvest constraint, along with other ongoing conservation efforts; has contributed to stable or increasing abundance trends in escapement. However, the abundance trend in the natural-origin returns suggests that, although escapement may be stable or even trend upward toward or above the optimum level associated with current habitat condition, natural-origin recruitment will not increase much beyond that level unless constraints limiting survival prior to entry to fisheries are alleviated

The reductions of harvest pressure, along with improvements in other sectors, appears to have contributed to stabilized natural-origin escapement, in areas where data is available, and the listed hatchery supplementation program further guards against catastrophic decline. While acknowledging the risk of density dependent effects, implementing the RMP will experimentally test production at these higher escapement levels, and capitalize on favorable survival conditions that may occur.

(3) Spatial Structure

The spatial structure of a population results from a complex interaction of the genetic and life history characteristics of a population, the geographic and temporal distribution and quality of habitat, and the disturbance level of the habitat. Although the understanding of these interactions is limited, the ability of individuals to successfully colonize and move through habitat at each subsequent life stage is essential for population viability.

Spatial structure should be taken into account in the analysis of the populations with the implementation of the RMP for at least three reasons: 1) the spatial and temporal distribution, quantity, and quality of habitat (landscape structure) dictates how effectively juvenile and adult salmon can bridge freshwater, estuarine, nearshore and marine habitat patches during their life cycle; 2) there is a time lag between changes in spatial structure and population response, and extinction risk at the 100-year time scale may be affected in ways not readily apparent from short-term observations of abundance and productivity; and 3) population spatial structure affects evolutionary processes and may therefore alter a population's ability to respond to environmental change (PSTRT 2003).

A fishery could target a certain portion of the run, which may result in a decrease in the number of spawners destined to a particular spawning location or population through time. For example, the early portion of a run of salmon may be the fish that will spawn the farthest upstream. If a fishery harvests just the early portion of the total adult return, the percentage of the population spawning in the upper portion of the system may be changed.

In Puget Sound, the co-managers generally shape salmon fisheries to harvest throughout the run timing of the returning adults. However, when harvest must be reduced, fishing-related mortality on listed chinook salmon is reserved as incidental harvest in salmon fisheries directed at other species. In these situations, the salmon fishery may concentrate incidental fishing-related mortality on the extreme ends of the run timing of listed fish in order to protect the majority of the run while providing access to other salmon species. The extent that a fishery may concentrate incidental fishing-related mortality on the extreme ends of the run could vary from year to year. In mixed-population salmon fisheries, harvest generally occurs throughout the migration of the returning chinook salmon. In terminal areas where chinook salmon are caught incidentally in fisheries targeting other species, harvest probably affects 15 percent or less of the run on either end of the run timing. There is currently no information to indicate that these incidental impact salmon fisheries are having deleterious effects on certain segments of the populations or to the ESU. For example, NMFS' status review (Myers *et al.* 1998) did not note any trends in size, weight, fecundity or other life history traits for Puget Sound chinook salmon that might be a result of fishing activities.

The spatial structure of the Mid-Hood Canal Management Unit is unique among the proposed management units. The Mid-Hood Canal Management Unit contains only one population, the Mid-Hood Canal rivers population (Category 2), which is composed of an aggregation of spawners from several adjacent rivers that are tributaries to Hood Canal. Unlike other populations within the ESU, these spawning aggregations are separated by salt water. Since most harvest impacts on this population occur outside Hood Canal, it is difficult for the co-managers to impose differential harvest effects on the individual spawning aggregate components in order to adjust spawning distribution among the rivers (W. Beattie, NWIFC, e-mail to K. Schultz, NMFS, January 31, 2004). For all populations, the RMP provides general guidelines to avoid focusing harvest on any one temporal segment of the return. The RMP establishes a low abundance threshold of 400 fish, which combines all the spawning components within the Mid-Hood Canal Management Unit. The RMP's aggregate upper management threshold for the Hood Canal Management Unit is 750 fish.

The historical structure of the Hood Canal chinook salmon population is unknown (PSTRT 2003). Historical returns and distributions of chinook salmon in Hood Canal have been affected by construction of dams, fisheries, and the introduction of non-native fish. The largest uncertainty within the Hood Canal populations, as identified by the TRT, is the degree to which chinook salmon spawning aggregations are demographically linked in the Hamma Hamma, Duckabush, and the Dosewallips Rivers. A possible alternative scenario, as identified by the TRT, is that the chinook salmon in the Hammam Hamma, Duckabush, and Dosewallips were independent populations (NMFS 2004b). Habitat differences do exist among these Mid-Hood Canal rivers. The Dosewallips River is the only system in the snowmelt-transition hydroregion (PSTRT 2003).

Although the TRT has identified two independent populations within Hood Canal Region[8] (the Skokomish and Mid-Hood Canal rivers populations), the TRT noted that important components of the historical diversity may have been lost, potentially due, in part, to the use of transplanted Green River origin fish for hatchery production in the region (PSTRT 2003). Life history information for the extant populations within Hood Canal Region was not useful in discriminating different populations (PSTRT 2003). The TRT also found genetic data not informative in reconstructing population structure under historical conditions. Allele frequencies between the Skokomish River population and the spawning aggregate in the Hamma Hamma River (Mid-Hood Canal rivers population) were not different ($P = 0.136$ as reported in PSTRT 2003). Extant Hood Canal chinook salmon belonged to the same genetic cluster as late-returning chinook salmon southern populations within the South Puget Sound Region (see Figure 5 in PSTRT 2003).

The 1999 to 2002 average escapement of 404 fish for the Mid-Hood Canal rivers population is only slightly above the co-managers' low abundance threshold of 400 fish (see Table 9). The Mid-Hood Canal Management Unit has exhibited an increasing escapement trend since listing (see Table 9). However, escapement trends in the individual rivers comprising the Mid-Hood Canal rivers population have not varied uniformly.

In recent years, the spawning aggregation in the Hamma Hamma River has generally comprised the majority of the Mid-Hood Canal rivers population (Table 12). In comparison, the Dosewallips River has seen a decrease in escapement during this same time period. Spawning

[8] The TRT identified five geographic regions within the Puget Sound Chinook Salmon ESU, which are based on similarities in hydrographic, biogeographic, and geologic characteristics. The TRT's regions will be discussed in more detail later within this document.

levels below 40 fish have been observed in recent years in the Duckabush and Dosewallips Rivers (see Table 6). However, exchange among the three spawning aggregations within the Mid-Hood Canal Management Unit, and with other Hood Canal natural and hatchery populations is probable (W. Beattie, NWIFC, e-mail com., to K. Schultz, NMFS, January 31, 2004). The demographic risks to the Mid-Hood Canal rivers population may be buffered by this straying at all abundance levels.

Table 12. The trend of the Mid-Hood Canal rivers population's individual spawning aggregates.

Mid-Hood Canal Rivers Population	1991 to 1995, 1998		1999 to 2002		Percent Difference [1]
	Average	Percent of Total	Average	Percent of Total	
All Spawning Components:	178	100.0%	404	100.0%	127%
Hamma Hamma River	64	36.0%	304	75.3%	375%
Duckabush River	17	9.6%	57	14.1%	235%
Dosewallips River	97	54.4%	43	10.6%	-56%

[1] The Percent Difference is the difference in percent of the 1999 to 2002 average escapement when compared to the 1991 to 1995, 1998 average escapement

The TRT suggests that most of the historical chinook salmon spawning in the Mid-Hood Canal rivers was "likely to [have] occurred in the Dosewallips River because of its larger size and greater area accessible to anadromous fish" (PSTRT 2003). However, production from the Hamma Hamma Fall Chinook Restoration Program, a hatchery-based supplementation program, has contributed substantially to the Mid-Hood Canal rivers population. The goal of the restoration program is to restore a healthy, natural-origin, self-sustaining population of chinook salmon to the Hamma Hamma River. This hatchery production is at least partially responsible for the recent increase in escapement observed in the Hamma Hamma River.

During 1999, it is estimated that about 77 percent of age-3 chinook salmon and 97 percent of age-4 chinook salmon spawning in the Hamma Hamma River were of hatchery origin. Overall, 83 percent of the chinook salmon returning to the Hamma Hamma River was hatchery-origin fish (as cited by WDFW/LLK 2002). The Hamma Hamma River hatchery-origin production has contributed substantially to the Mid-Hood Canal Management Unit's overall increasing escapement trend since listing (see Table 9). The program may also buffer demographic risks to the Mid-Hood Canal rivers population in the short term, particularly to the natural-origin spawning aggregate returning to the Hamma Hamma River.

The range of anticipated aggregate spawning escapements into the rivers of the Mid-Hood Canal Management Unit under the implementation of the RMP is 344 to 531 fish (see Table 3). The most likely escapement within in this range is 504 fish (see Table 5). Benefits to this population from reductions in fisheries-related impacts are limited. The co-managers, in cooperation with NMFS, have modeled escapement results under a no Puget Sound fishery alternative, and the most likely escapement under the "no fishery" scenario is 527 fish in the Mid-Hood Canal Management Unit, as discussed in more detail in the FEIS. With no Puget Sound fishing, escapement into the Mid-Hood Canal rivers population is only predicted to be increase by 23 fish, from 504 to 527 fish. Given the ratio of recent escapements into the individual river systems in the Mid-Hood Canal Management Unit (see Table 12), totally eliminating Puget Sound fisheries would only increase escapements into the Duckabush (14.1 percent of 23) and Dosewallips (10.6 percent of 23) Rivers by 3 and 2 fish, respectively.

Because of the currently low numbers of spawners in the individual rivers, and with there being no provision within the RMP to preserve the spatial structure of the escapement within and between component rivers for the Mid-Hood Canal rivers population there is a increased level of concern for the spatial structure of the escapement for this population. Additional discussion on this elevated level of concern for the Mid-Hood Canal rivers population, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

(4) Diversity

The transfer from parents to offspring (heritability) of certain biological traits such as age at maturity, growth rate, and the effect of these traits on each other has been researched and described (Clark and Blackbird 1994; Donaldson and Menasveta 1961; Hankin *et al.* 1993; Heath *et al.* 1994b; and Silverstein *et al.* 1998). Under certain circumstances, fishing may influence the biological traits of salmon that return to spawn, and potentially the traits that are conveyed to their offspring.

Diversity in biological traits is important so that populations can successfully respond to changing environmental conditions. For example, numerous studies have emphasized the possible importance of large size in naturally-spawning populations of chinook salmon for mate choice and reproductive success (Baxter 1991; Berejikian *et al.* 2000; Healey 2001; Healey and Heard 1984; and Silverstein and Hershberger 1992). A fishery is characterized as selective whenever fish with particular characteristics are caught more frequently than they occur in the population at large. Selective fishing may affect the diversity of size, age and sex ratio in the salmon population escaping to spawn.

Salmon fisheries may be size-selective, stock-selective, or species-selective. Size-selective fisheries catch fish within a certain size range at a greater rate than smaller or larger fish. Stock-selective fisheries harvest some populations at different rates than other populations. Fisheries are usually deliberately structured to be stock-selective or species-selective by shaping the time, location or physical attributes of fish that may be caught. Harvest managers have implemented stock- and species-selective fisheries in Puget Sound.

Selective Effects of Fishing in Puget Sound:

Although the potential consequences of size-selective fishing have been recognized, the ability of fisheries managers to address the potential long-term consequences is limited. The magnitude of selective effects will vary depending on the intensity of selective-fishing on a particular salmon population, the period of time over which those effects are encountered, and the biological characteristics of the population itself (Heath *et al.* 1994a; and Hard 2004). Hard (2004) predicted that, in general, reducing the exploitation rate reduces the selection intensity, and that changes in life history traits under most of the harvest scenarios he examined were modest, at best, over a few generations.

Information on the effects of fishery selectivity on Puget Sound chinook salmon is very limited. NMFS found a decline in the size of Puget Sound coho salmon spawners since the 1970s, and noted it as a risk factor (Weitkamp *et al.* 1995). However, in its review of west coast chinook salmon populations (Myers *et al*. 1998), NMFS did not note any trends in recent decades for size, weight, or age for Puget Sound chinook salmon that might be the result of fishing activities. The lack of an observed selective-fishing effect may be the result of the way Puget Sound fisheries are structured. Puget Sound salmon fisheries, including those harvesting chinook salmon, are managed for stock-specific exploitation rates that depend on the underlying productivity of each population.

With regard to the potential age-selectivity of fishing gear types, Puget Sound gillnet fisheries do not appear to be any more age-selective for chinook salmon than gear types like purse seines that use small mesh and are thus considered to be relatively non-selective (Table 13 and Figure 5). Based on the Puget Sound population-specific data that are available, there are no trends in age structure observed in Puget Sound chinook salmon escapement over the last 24 to 30 years that one might expect if there were age-selective fishing effects (Figure 6).

Table 13. Average age composition of the Puget Sound chinook salmon catch by gear type.

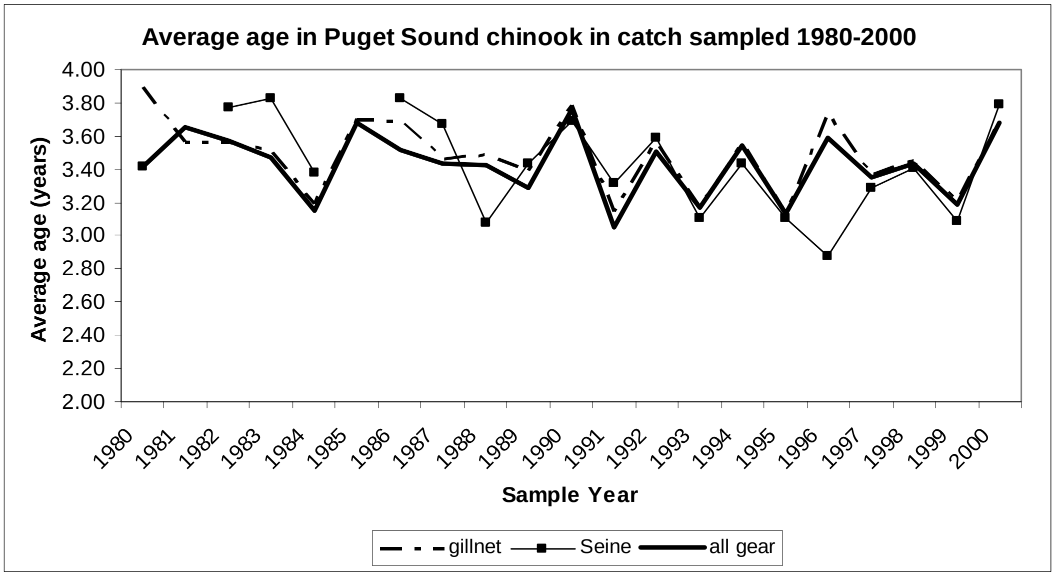
Gear Type	Age composition of Puget Sound chinook salmon catch (1980–2000)			
	Age-2	Age-3	Age-4	Age-5
Gillnet	3%	34%	59%	5%
Purse seine	7%	37%	54%	4%
All gear types	3%	35%	56%	6%

Source: S. Bishop, National Marine Fisheries Service, Northwest Region, based on data provided by the Washington Department of Fish and Wildlife.

NMFS also conducted analyses to determine whether there was a difference in size at age between Puget Sound chinook salmon caught in the fishery and those that spawn. NMFS focused its analyses on a subset of Puget Sound chinook salmon populations for which sufficient information was available and that represented some diversity in life history (spring and fall run types), geographic distribution and fishing intensity. NMFS also limited its analysis to terminal in-river net fisheries[9] for which data were available so that the analyses were not confounded by the catch of immature fish that commonly occurs in marine fisheries. The analyses were broken into three steps: (1) compare the average size at age and sex of coded-wire tagged fish recovered in the terminal net fishery with those recovered in the hatchery escapement; (2) size at age and sex information collected from naturally spawning adults was compared with results for

[9] These fisheries intercept fish returning to a single river system; the one in which the fishery occurs.

returning hatchery adults; and, (3) analysis was conducted to see whether the magnitude of change in size could be linked to effects of the terminal fishery.



Source: Puget Sound Technical Recovery Team data.

Figure 5. Age composition of Puget Sound chinook salmon catch. Average age has changed little since 1980.

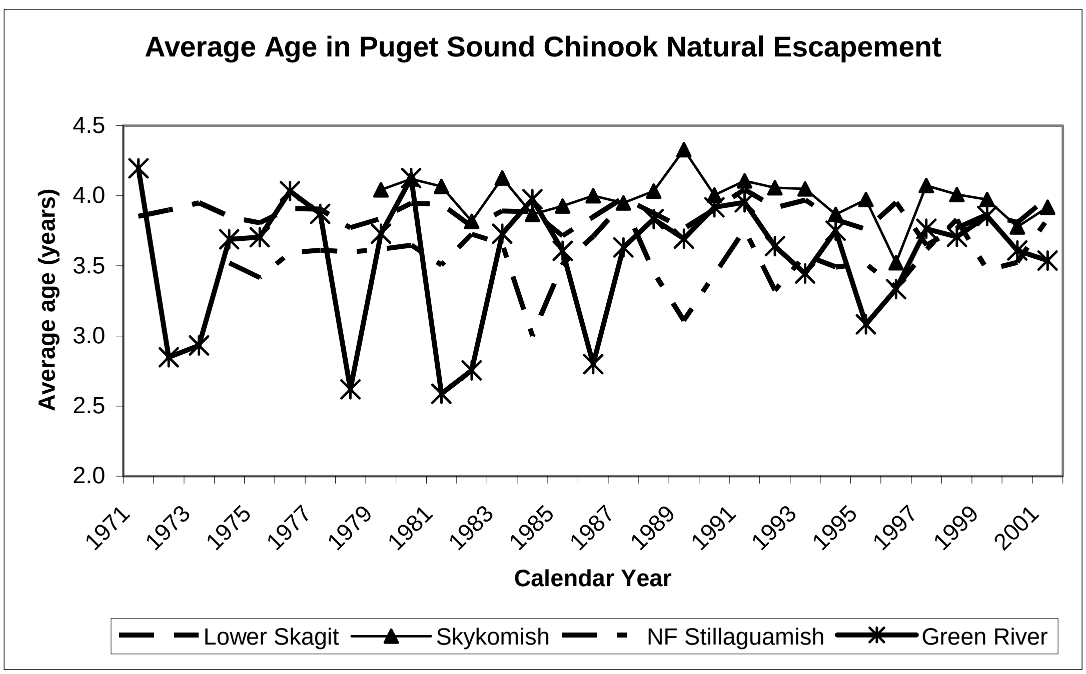


Figure 6. Age composition of Puget Sound chinook salmon escapement. Average age has changed little since the 1970s.

In the first step, the average size at age and sex of coded-wire tagged fish recovered in the terminal net fishery was compared with those recovered in the hatchery escapement during the period 1975-2001. The use of coded-wire tagged fish ensured that the analysis included only fish from the same population based on the unique coded-wire tag code implanted into the fish prior to their release from the hatchery.

Step 1 of the analysis indicates that there were significant trends in size at age and sex for some Puget Sound chinook salmon populations and shows some consistency with the expectation that populations with high exploitation rates would show declining trends in size for ages most likely to be affected by fishery selectivity. When populations with moderate to high terminal area exploitation rates are compared with populations with low exploitation rates, the populations with higher exploitation rates showed a consistent pattern of decreasing size at age for both male and female age four chinook salmon, one of the two ages most likely to experience any selective effects. Declines ranged from 0.11 to 0.45 centimeters per year or 0.55 to 2.5 centimeters per generation. Whether these changes are biologically significant is unknown. The majority of size at age trends for age three fish were not significant, regardless of fishing intensity.

On the other hand, other aspects of the results suggest factors other than fisheries are equally as likely: (1) the comparison between populations in moderate-high and low exploitation rate categories also compared populations with different life histories, so the difference could be due to differences in environmental conditions experienced by the different life history types; (2) the trends did not show consistent contrasts between the ages most vulnerable to selective fishing effects and those ages that are not, although this may have resulted from small numbers of samples for two- and five-year-old fish; (3) the trends in age-3 chinook which are also vulnerable to selective fishing effects were generally insignificant regardless of fishing intensity; (4) the trends would also have reflected the result of cumulative selective pressures of fisheries other than Puget Sound terminal net fisheries; (5) the trends were not entirely consistent between high and low exploitation rate populations when total exploitation rates are considered. While the terminal area exploitation rates were low for Skagit River spring chinook, the total exploitation rate was similar to those of the Green and Skokomish Rivers and the Samish River showed no significant trends in size-at-age, although it is classified as a moderate to high exploitation rate population.

In the second step of the analysis, size at age and sex information collected from naturally spawning adults was compared with results from the first step. Only three of the six Puget Sound chinook salmon populations, including only one of the four populations in the moderate-high exploitation rate category, evaluated in step 1 had sufficient data available to conduct the analysis. The trends in size at age were significant for five of the six analyses conducted. For all but one of these population/age groups examined, the trends in size at age were not significantly different among males and females. Although limited, the results of these did not indicate declining trends in size with higher exploitation rates. In general; (1) the trends were increasing for both high and low exploitation rate populations; (2) the trend of size-at-age is mixed among ages most likely to experience selective effects of fisheries; and (3) as in the step 1 analysis, the apparent differences in magnitude of change between the high and low exploitation rate populations could be the result of difference in environmental effects on different life history strategies.

The results in steps 1 and 2 are consistent in direction and significance of trends for only two of the six analyses that were compared and the magnitude of change was substantially different between the analyses that were similar. Both analyses indicated trends between male and female chinook salmon spawners were similar. The results of the analyses in step 2 seem to indicate that trends of size at age and sex between the hatchery and naturally spawning components are different. The results do not indicate that fisheries are affecting the naturally spawning component of the population in the ways that might be expected, i.e., declining size at age with increasing exploitation. The differences in the two analyses could reflect actual differences between trends in size-at-age in hatchery and naturally-spawning adult chinook, differences in the sampling and data collection in the two environments, or differences in life history.

From the discussion above, it is evident that analyses of observed trends alone cannot confirm that harvest is primarily responsible for declines in size at age; therefore, an analysis was conducted to see whether the magnitude of change in size could be linked to the intensity of the fishery (Step 3). To do this, the populations were assessed using the models of Hard (2004) to determine to what extent fisheries might be a factor where statistically significant patterns in size at age and sex were identified in the first two steps. The model examined four possible scenarios: two levels of legal size threshold (50 and 70 centimeters) and two levels of natural selection intensity (strong and weak) on size (J. Hard, Northwest Fisheries Science Center, pers. com., to S. Bishop, NMFS, September 16, 2004). This step compares what the trends in size at age would be under different levels of environmental and fishing conditions with the results in step 1 to see if the observed trends are consistent with any of the scenarios. The same general conclusions with regard to increasing and decreasing trends are equally applicable to results from step 2.

The analysis resulted in a mixture of upward and downward observed trends. The expected trends estimated by the harvest model generally explained less then 50 percent of corresponding observed trends. These results suggest that environmental influences on the observed size trends are large. For decreasing observed trends, these influences may include factors such as environmental conditions that reduce growth and size, or artificial or domestication selection in the hatchery. However, these influences also appear to vary considerably among the populations, pointing to the possibility of marked population-environment interaction effects. For increasing observed trends, these influences are likely to reflect environmental conditions that enhance growth and size, which could result from more favorable marine conditions, improvements in hatchery practices, reductions in harvest intensity, changes in migration patterns, or other factors that affect growth and size. Unfortunately, it is not possible from the present analysis to determine the directions or magnitudes of these environmental effects for any particular population with confidence because harvest and environmental effects on growth and size cannot be discriminated reliably.

(5) Section (b)(4)(i)(C) Sets escapement objectives or maximum exploitation rates for each management unit or population based on its status, and assures that those rates or objectives are not exceeded.

Table 2 identifies the proposed RMP's rebuilding exploitation rates and critical exploitation rate ceilings, which when taken in concert with the RMP's upper management thresholds and low abundance thresholds forms the framework of the co-managers' harvest strategy. NMFS independently established rebuilding exploitation rates for nine individual populations within the ESU and for the Nooksack Management Unit (Table 14). For individual populations, exploitation rates at or below the NMFS-derived rebuilding exploitation rates are not likely to appreciably reduce the likelihood of rebuilding that population, assuming that current environmental conditions continue.

The following will provide a risk analysis of the anticipated exploitation rates under the implementation of the RMP's harvest strategy in those management units for which NMFS has derived rebuilding exploitation rates. Additionally, there are eight management units for which NMFS has yet to derive a rebuilding exploitation rate. These eight management units lacking a NMFS-derived rebuilding exploitation rates are the Lake Washington, White River, Puyallup, Nisqually, Skokomish, Mid-Hood Canal, Dungeness, and Elwha Management Units. NMFS did not develop rebuilding exploitation rates for these management units because adequate data were not available to assess current productivity or analysis is as yet incomplete. A risk analysis of the proposed RMP's harvest strategy for these eight management units will follow the analysis of management units with the NMFS-derived rebuilding exploitation rates.

Management Units that can be evaluated using NMFS-derived rebuilding exploitation rates as standards:

Modeling provides an estimate of the most likely exploitation rates and their ranges anticipated under the implementation of the RMP (see Table 3). The anticipated total exploitation rates under the implementation of the RMP are compared with the NMFS-derived rebuilding exploitation rates in Table 14.

The range of anticipated exploitation rates under the implementation of the RMP are equal to or less than the rebuilding exploitation rate developed by NMFS for five populations. These five populations are: the Upper Skagit River in the Skagit Summer/Fall Management Unit; the Upper Sauk River and Suiattle River populations in the Skagit Spring Management Unit; and, the North Fork Stillaguamish River and the South Fork Stillaguamish River populations in the Stillaguamish Management Unit. The level of risk associated with the anticipated range of exploitation rates for these five populations are consistent with the NMFS-derived rebuilding exploitation rates.

The entire range of anticipated exploitation rates for the Nooksack Management Unit and the Snohomish Management Unit exceeds the corresponding NMFS-derived rebuilding exploitation rate (Table 14). In addition, the most likely anticipated exploitation rates under the implementation of the RMP in three populations (the lower Skagit River and the lower Sauk River populations in the Skagit Summer/Fall Management Unit, and the Duwamish-Green River population in the Green River Management Unit) exceeds the corresponding rebuilding exploitation rate developed by NMFS.

Table 14. The range of anticipated total exploitation rates under the implementation of the RMP and the NMFS-derived rebuilding exploitation rate.

Management Unit	Population	Range of Anticipated Total Exploitation Rates	Most Likely Total Exploitation Rate	NMFS-derived Rebuilding Exploitation Rate
Nooksack	Natural-Origin Spawner:	20 to 26%	25%	*12%*
	North Fork Nooksack	-	-	-
	South Fork Nooksack	-	-	-
Skagit	Natural Spawners:			-
Summer/Fall [1]	Upper Skagit River	48 to 56%	55%	*60%*
	Lower Sauk River	-	-	*51%*
	Lower Skagit River	-	-	*49%*
Skagit	Natural Spawners:	23 to 28%	27%	-
Spring	Upper Sauk River	-	-	*38%*
	Suiattle River	-	-	*41%*
	Upper Cascade River	-	-	-
Stillaguamish	Natural-Origin Spawners:	17 to 20%	19%	-
	N.F. Stillaguamish River	-	-	*32%*
	S.F. Stillaguamish River	-	-	*24%*
Snohomish	Natural-Origin Spawners:	19 to 23%	22%	-
	Skykomish River	-	-	*18%*
	Snoqualmie River	-	-	-
Lake	Natural Spawners:			-
Washington	Cedar River	31 to 38%	35%	-
	Sammamish River	-	-	-
Green River	Natural Spawners:			
	Duwamish-Green River	49 to 63%	63%	*53%*
White River	Natural Spawners:			
	White River	20%	20%	-
Puyallup	Natural Spawners:			
	Puyallup River	49 to 50%	50%	-
Nisqually	Natural Spawners:			
	Nisqually River	64 to 76%	76%	-
Skokomish	Natural Spawners:			
	Skokomish River	45 to 63%	63%	-
Mid-Hood	Natural Spawners:			
Canal	Mid-Hood Canal Rivers	26 to 34%	32%	-
Dungeness	Natural Spawners:			
	Dungeness River	22 to 29%	27%	-
Elwha	Natural Spawners:			
	Elwha River	22 to 30%	27%	-

[1] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 that lead to increased incidental harvest of chinook salmon make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts.

NMFS analyzed the increased risk associated with the proposed SUS fisheries by using the NMFS-derived rebuilding exploitation rates as the standard. The risk analysis simulates exposure of a population to a fixed brood-year exploitation rate, adjusted annually for management error and environmental variability, for a period of 25 years. When compared to NMFS-derived rebuilding exploitation rates, the risk analysis can predict: (1) the change in the probability of achieving the viable threshold; and (2) the change in probability of falling below the critical threshold.

In assessing the potential risk of SUS fisheries, NMFS assumes a low marine survival, which is conservative and risk adverse. Additionally, the actual brood-year exploitation rates experienced in this RMP over the next five years, from May 1, 2005 through April 2010, although fixed in the simulations, will vary. The RMP's rebuilding exploitation rates or escapement goals may modified in response to the most current information about the productivity and status of populations, or in response to better information about management error. There is also uncertainty in the risk analysis simulation about actual exploitation rates beyond the duration of the proposed RMP (April 30, 2010). The NMFS-derived rebuilding exploitation rates are based on simulations over a more conservative 25-year period, where the RMP's proposed duration is for a shorter duration, five years, from May 1, 2005 through April 2010.

Furthermore, the impact of fisheries in Alaska and British Columbia also adds uncertainty. Annex IV, Chapter 3, Chinook Salmon of the Pacific Salmon Treaty (PST 1999) imposes exploitation rate ceilings for fisheries impacts on indicator populations that are not achieving their escapement goals. Concern has heightened in recent years, as some Canadian chinook salmon fisheries have approached the limit imposed by Annex IV (W. Beattie, NWIFC, e-mail to K. Schultz, NMFS, January 31, 2004). The current Annex IV, Chapter 3, Chinook Salmon of the Pacific Salmon Treaty expires in 2009, so new guidelines could be imposed as a new annex is re-negotiated, or as the current harvest distribution of contributing populations is better defined.

Given these uncertainties, the following analyses estimate the potential elevated risk when compared to the NMFS-derived rebuilding exploitation rates as the standard for the proposed evaluation. This analysis is done for the four management units, identified above, in which the anticipated exploitation rates are above the rebuilding exploitation rates developed by NMFS. These four management units are the Nooksack, Snohomish, Skagit Summer/Fall, and the Green River Management Units.

Nooksack Management Unit - There are two populations within the Nooksack Management Unit: the North Fork Nooksack River and the South Fork Nooksack River populations. Both populations are currently classified as a Category 1 population (see Table 7). The North Fork Nooksack River natural-origin population has exhibited an increasing escapement trend (see Table 9). The 1999 to 2002 average escapement of 180 natural-origin spawners for the North Fork Nooksack River population is below the NMFS-derived critical threshold of 200 fish (see Table 8). The critical threshold for the Nooksack Management Unit is based on natural-origin fish. However, when including Kendall Creek hatchery-origin fish, an average aggregate escapement of 3,438 natural spawners for the North Fork Nooksack River has been observed since listing (see Table 10). The South Fork Nooksack River natural-origin population has also exhibited an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 249 natural-origin spawners for the South Fork Nooksack River population is slightly above the NMFS-derived critical threshold of 200 fish (see Table 8).

The co-managers propose to manage the Nooksack Management Unit by applying a 9 percent SUS critical exploitation rate ceiling (see Table 2). It also is the co-managers' intent to constrain fisheries affecting the management unit so that the projected SUS exploitation rate does not exceed 7 percent more than once during the duration of the RMP (see page 92 of the RMP). The RMP's SUS critical exploitation rate ceiling would not include impacts in Alaska or Canadian fisheries.

Similar to recent years, the largest proportion of the anticipated total exploitation rate for the Nooksack Management Unit is accounted for in Canadian fisheries (see Table 4). The resulting anticipated range of total exploitation rates for the Nooksack Management Unit under the implementation of the RMP is 20 to 26 percent (see Table 3). The most likely exploitation rate within this range is 25 percent (see Table 5). The NMFS-derived rebuilding exploitation rate for the Nooksack Management Unit is 12 percent (see Table 14). The entire range of anticipated exploitation rates under the implementation of the RMP for the Nooksack Management Unit of 20 to 26 percent exceeds the NMFS-derived rebuilding exploitation rate ceiling by 8 to 14 percentage points (Table 15).

Table 15. Comparison of the range of anticipated total exploitation rates with the NMFS-derived rebuilding exploitation rate for the Nooksack Management Unit.

Nooksack Management Unit or Population	Range of Anticipated Total Exploitation Rates	Most Likely Total Exploitation Rate	NMFS-derived Rebuilding Exploitation Rate	Difference in Percentage Points [1]		
				Low End of Range	Most Likely	High End of Range
Management Unit	20 to 26%	25%	12%	+8	+13%	+14%
N. F. Nooksack R.	-	-	-	-	-	-
S. F. Nooksack R.	-	-	-	-	-	-

[1] A positive number within the difference in percentage point column indicates that the corresponding anticipated exploitation rate exceeds the NMFS-derived rebuilding exploitation rate.

The management of Canadian fisheries is outside the jurisdiction of the co-managers. However, the co-managers do have jurisdiction over SUS fisheries. The most likely exploitation rate for the SUS fisheries is 7 percent (see Table 5). NMFS determined the increased risk associated with the SUS fisheries proposed by the co-managers in the RMP, when compared to the NMFS-derived rebuilding exploitation rate. With the modeled Canadian fisheries and a 7 percent SUS exploitation rate for the Nooksack River populations, assuming 2003 abundance, the anticipated total exploitation rate represents a 6 percentage point decrease in the probability of rebuilt populations in 25 years. Modeling also suggests that there is a 21 percentage point increase in the probability that the populations will fall below their respective critical threshold level during that same 25-year period (Table 16). The anticipated total exploitation rate includes impacts from both the Canadian and SUS fisheries. The exploitation rates from just the modeled Canadian fisheries exceeds NMFS-derived rebuilding exploitation rate for the Nooksack River populations of 12 percent. We can also isolate the effects of only the SUS fisheries. Using the exploitation rate in Canadian and Alaskan fisheries as a baseline, i.e., the mortality that has occurred prior to SUS fisheries, a 7 percent SUS exploitation rate for the Nooksack River populations represents a 2 percentage point decrease in the probability of rebuilt populations in 25 years. Modeling also suggests that a 7 percent SUS exploitation rate for the Nooksack River populations represents a 14 percentage point increase in the probability that the populations will fall below their respective critical threshold level during that same 25-year period.

Additional discussion on this identified elevated level of risk to the North Fork Nooksack River and South Fork Nooksack River populations under the implementation of the RMP, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

Skagit Summer/Fall Management Unit - The Skagit Summer/Fall Management Unit encompasses three populations: the upper Skagit, the lower Sauk, and the lower Skagit River populations. All three populations are classified as a Category 1 population (see Table 7). Since listing, all populations in the Skagit Summer/Fall Management Unit have exhibited an increasing escapement trend (see Table 9). The 1999 to 2002 average escapements for all three populations are above their respective viable thresholds (see Table 8).

The co-managers propose to manage the Skagit Summer/Fall Management Unit with a 50 percent total rebuilding exploitation rate, and a 15 percent SUS critical exploitation rate ceiling in even-years and a 17 percent SUS critical exploitation rate ceiling in odd-years (see Table 2). The resulting anticipated range of total exploitation rates for the Skagit Summer/Fall Management Unit under the implementation of the RMP is 48 to 56 percent (see Table 3). The most likely total exploitation rate within this range is 55 percent (see Table 5).

The NMFS-derived rebuilding exploitation rates for the individual populations within the Skagit Summer/Fall Management Unit are shown in Table 17. The lower end of the range of anticipated total exploitation rates of 48 percent under the implementation of the RMP is less than the NMFS-derived rebuilding exploitation rate ceiling for all three populations within the Skagit Summer/Fall Management Unit. When the most likely total exploitation rate of 55 percent is applied to the individual populations within the management unit, the exploitation rate is less than the NMFS-derived rebuilding exploitation rate for the upper Skagit River population, but exceeds the NMFS-derived rebuilding exploitation rate for the lower Sauk River and lower Skagit River populations by 4 and 6 percentage points, respectively (Table 17).

Table 16. The percentage point change in probability of a rebuilt population in 25 years and the percentage point difference in probability that the population will fall below the critical threshold in 25 years when the anticipated total exploitation rates are compared to the NMFS-derived rebuilding exploitation rates. The anticipated total exploitation rates include the impacted associated with the modeled Canadian fisheries and the anticipated southern United States (SUS) fisheries in the RMP.

Management Unit	Population	Lower End of Range		Most Likely		Upper end of Range	
		Percentage Point difference in Probability of a Rebuilt Population in 25 Years[1]	Percentage Point difference in Probability that the Population will fall below the Critical Threshold in 25 Years[2]	Percentage Point difference in Probability of a Rebuilt Population in 25 Years[1]	Percentage Point difference in Probability that the Population will fall below the Critical Threshold in 25 Years[2]	Percentage Point difference in Probability of a Rebuilt Population in 25 Years[1]	Percentage Point difference in Probability that the Population will fall below the Critical Threshold in 25 Years[2]
Nooksack		- 6%	9%	- 6%	21%	- 12%[3]	22%[3]
	N. F. Nooksack River	-	-	-	-	-	-
	S.F. Nooksack River	-	-	-	-	-	-
Skagit Summer/Fall	Upper Skagit River	-	-	-	-	-	-
	Lower Sauk River	-	-	-	-	-	-
	Lower Skagit River	-	-	- 26%	0%	- 33%	0%
Skagit Spring	Upper Sauk River	17%	- 0%	16%	- 0%	16%	- 0%
	Suiattle River	19%	-1%	19%	- 1%	18%	- 1%
	Upper Cascade River	-	-	-	-	-	-
Stillaguamish	N. F. Stillaguamish R.	14%	- 1%	14%	- 1%	15%	- 1%
	S.F. Stillaguamish R.	9%	- 1%	4%	- 1%	4%	- 1%
Snohomish	Skykomish River	- 4%	1%	- 14%	3%	- 15%	3%
	Snoqualmie River	-	-	-	-	-	-

[1] A negative number in the difference in probability of a rebuilt population in 25 years indicates a decrease in the probability of that population being rebuilt in 25 years, when compared to the NMFS-derived rebuilding exploitation rate. A positive number in the difference in probability of a rebuilt population in 25 years indicates an increase in the probability of that population being rebuilt in 25 years, when compared to the NMFS-derived rebuilding exploitation rate. Rebuilt is defined as the population's abundance meeting or exceeding its viable threshold under current conditions.

[2] A negative number in the difference in probability that the population will fall below the critical threshold in 25 years indicates a decrease in the probability of that population will fall below the critical threshold in 25 years, when compared to the NMFS-derived rebuilding exploitation rate. A positive number in the difference in probability that the population will fall below the critical threshold in 25 years indicates an increase in the probability of that population will fall below the critical threshold in 25 years, when compared to the NMFS-derived rebuilding exploitation rate.

[3] The anticipated total exploitation rate includes impacts from both the Canadian and SUS fisheries. The exploitation rates from just the modeled Canadian fisheries exceeds NMFS-derived rebuilding exploitation rate for the Nooksack River populations. When assessing the impacts of just the SUS fisheries, a 7 percent SUS exploitation rate for the Nooksack River populations represents a 2 percentage point decrease in the probability of rebuilt populations in 25 years. Modeling also suggests that a 7 percent SUS exploitation rate for the Nooksack River populations represents a 14 percentage point increase in the probability that the populations will fall below their respective critical threshold level during that same 25-year period.

Table 17. Comparison of the range of anticipated total exploitation rates for the Skagit Summer/Fall Management Unit with the NMFS-derived rebuilding exploitation rate for individual populations within the Skagit Summer/Fall Management Unit.

Skagit Summer/Fall Management Unit or Population	Range of Anticipated Total Exploitation Rates [1]	Most Likely Total Exploitation Rate [1]	NMFS-derived Rebuilding Exploitation Rate	Difference in Percentage Points [2]		
				Low End of Range	Most Likely	High End of Range
Management Unit	48 to 56%	55%	-	-	-	-
Upper Skagit River	-	-	60%	-12%	-5%	-4%
Lower Sauk River	-	-	51%	-3%	+4%	+5%
Lower Skagit River	-	-	49%	-1%	+6%	+7%

[1] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 that lead to increased incidental harvest of chinook salmon make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts.
[2] A positive number within the difference in percentage point columns indicates that the corresponding anticipated exploitation rate exceeds the NMFS-derived rebuilding exploitation rate.

Similar to the Nooksack Management Unit discussed above, the anticipated impacts on the Skagit Summer/Fall Management Unit include those from the Canadian fisheries. The management of Canadian fisheries is outside the jurisdiction of the co-managers. However, the co-managers do have jurisdiction over fisheries within the SUS. For the Skagit Summer/Fall Management Unit, the anticipated exploitation rate[10] range for the SUS fisheries is 16 to 18 percent (see Table 3). The most likely exploitation rate for the SUS fisheries is 16 percent (see Table 5).

Through modeling, NMFS determined the increased risk to the lower Skagit River population associated with the overall fishing-related mortality discussed in the RMP. The combined effects of the modeled Canadian fisheries, a 16 percent SUS exploitation rate, and abundance similar to 2003, would represent a 26 percentage point decrease in the probability of a rebuilt lower Skagit River population in 25 years. Modeling also suggests that there is no change in the probability that the population will fall below the critical level (see Table 16).

NMFS was unable to determine the increased risk associated with the anticipated exploitation rates under the implementation of the RMP exceeding the NMFS-derived rebuilding exploitation rate for the lower Sauk River population. However, the level of risk is assumed to be similar to that estimated for the lower Skagit River population. Additional discussion on the risks to the lower Sauk River and lower Skagit River populations under the implementation of the RMP, in

[10] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 rates that lead to increased incidental harvest of chinook salmon make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts.

regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

Snohomish Management Unit - The Snohomish Management Unit encompasses two populations: the Skykomish River and the Snoqualmie River populations. Both populations are classified as a Category 1 population (see Table 7) and both have exhibited an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 2,118 for the Skykomish River population has been above the critical threshold of 1,650 fish, but below the viable threshold of 3,500 fish (see Table 8). The 1999 to 2002 average escapements of 1,818 fish for the Snoqualmie River population have been above the VSP guidance for a viable threshold of 1,250 fish (see Table 8).

The co-managers propose to manage fisheries affecting the Snohomish Management Unit by applying a 21 percent total rebuilding exploitation rate and a 15 percent SUS critical exploitation rate ceiling (see Table 2). The resulting anticipated range of exploitation rates for the Snohomish Management Unit under the implementation of the RMP is 19 to 23 percent. The most likely exploitation rate within this range is 22 percent (Table 18).

Table 18. Comparison of the RMP's rebuilding exploitation rates for the Snohomish Management Unit with the NMFS-derived rebuilding exploitation rate for the Skykomish River population.

Snohomish Management Unit or Population	Range of Anticipated Total Exploitation Rates	Most Likely Total Exploitation Rate	NMFS-derived Rebuilding Exploitation Rate	Difference in Percentage Points [1]		
				Low End of Range	Most Likely	High End of Range
Management Unit	19 to 23%	22%	-	-	-	-
Skykomish River	-	-	18%	+1%	+4%	+5%
Snoqualmie River	-	-	-	-	-	-

[1] A positive number within the difference in percentage point column indicates that the corresponding anticipated exploitation rate exceeds the NMFS-derived rebuilding exploitation rate.

The NMFS-derived rebuilding exploitation rate for the Skykomish River population is 18 percent. The range of anticipated total exploitation rates for the Snohomish Management Unit is 19 to 23 percent. The entire range exceeds the NMFS-derived rebuilding exploitation rate of 18 percent for the Skykomish River population; by 1 to 5 percentage points (see Table 18).

Although not as prominent as in the Nooksack and Stillaguamish Management Units discussed above, the anticipated impacts on the Snohomish Management Unit also include those from the Canadian fisheries (see Table 4). The management of Canadian fisheries is outside the jurisdiction of the co-managers. However, the co-managers do have jurisdiction over fisheries within the SUS. For the Snohomish Management Unit, the anticipated range of exploitation rates for the SUS fisheries is 13 to 14 percent (see Table 3). The most likely exploitation rate within in this range is 13 percent (see Table 5).

Through modeling, NMFS analyzed the increased impacts associated with the overall fishing-related mortality discussed in the RMP, when compared to the NMFS-derived rebuilding exploitation rate as the standard. The combined effects of the modeled Canadian fisheries, a 13 percent SUS exploitation rate for the Skykomish River population, and assuming 2003 abundance, would represent a 14 percentage point decrease in the probability of a rebuilt population in 25 years. Modeling also suggests that there is a 3 percentage point increase in the probability that the population will fall below the critical level during that same 25-year period (see Table 16). Additional discussion on the identified elevated level of risk to the Skykomish River population under the implementation of the RMP, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

Lacking sufficient data, no rebuilding exploitation rate has been developed by NMFS for the other population within the Snohomish Management Unit, the Snoqualmie River population. The risk associated with the proposed exploitation rate in the RMP to the Snoqualmie River population will be addressed in the following subsection, *Management Units for which NMFS-derived Rebuilding Exploitation Rate standards are not available*.

Green River Management Unit - The Green River Management Unit includes only one population, the Duwamish-Green River population (Category 1). The Duwamish-Green River population has exhibited an increasing escapement trend (see Table 9). The 1999 to 2002 average escapement of 9,299 for the Duwamish-Green River population has been above the viable threshold of 5,523 (see Table 8).

The co-managers propose to manage the Green River Management Unit with a 15 percent pre-terminal SUS rebuilding exploitation rate and a 12 percent pre-terminal SUS critical exploitation rate ceiling (see Table 2). The RMP's pre-terminal SUS rebuilding exploitation rate and the pre-terminal SUS critical exploitation rate ceiling would not include impacts in terminal fisheries. The co-managers propose to manage the terminal fisheries of the Green River Management Unit based on an in-season estimate of the run-size abundance. The in-season run-size abundance estimate allows the co-managers to manage the fisheries to achieve the natural escapement goal of 5,800 fish (see page 160 of the RMP). The resulting anticipated range of total exploitation rates for the Green River Management Unit under the implementation of the RMP is 49 to 63 percent. The most likely total exploitation rate within this range is 63 percent (Table 19). The NMFS-derived rebuilding exploitation rate for the Duwamish-Green River population is 53 percent (Table 19).

The lower end of the anticipated range of exploitation rates under the implementation of the RMP of 49 percent is less than the NMFS-derived rebuilding exploitation rate of 53 percent. The level of risk associated with the lower end of the range of anticipated exploitation rates for the Duwamish-Green River population is consistent with the NMFS-derived rebuilding exploitation rate as the standard. However, the most likely exploitation rate for the Duwamish-Green River population of 63 percent exceeds the NMFS-derived rebuilding exploitation rate by 10 percentage points (Table 19).

Table 19. Comparison of the RMP's rebuilding exploitation rates with the NMFS-derived rebuilding exploitation rate for the Duwamish-Green River population.

Green River Management Unit / Population	Range of Anticipated Total Exploitation Rates	Most Likely Total Exploitation Rate	NMFS-derived Rebuilding Exploitation Rate	Difference in Percentage Points [1]		
				Low End of Range	Most Likely	High End of Range
Duwamish-Green River	49 to 63%	63%	53%	-2%	+10%	+10%

[1] A positive number within the difference in percentage point column indicates that the corresponding anticipated exploitation rate exceeds the NMFS-derived rebuilding exploitation rate.

The co-managers' escapement goal of 5,800 fish for the Duwamish-Green River population have been successfully achieved by the co-managers annually since 1995 (see Table 6). Modeling of the Green River Management Unit indicates that with the implementation of the proposed RMP from May 1, 2005 through April 30, 2010, the escapement goal of 5,800 fish is likely to be continually achieved. The co-managers' escapement goal of 5,800 fish for the Duwamish- Green River population is above the NMFS-derived viable threshold for this population of 5,523 fish (see Table 8). With the level of escapement anticipated to continue to exceed the NMFS-derived viable threshold, the level of risk to the Duwamish-Green River population that is associated with the anticipated range of exploitation rates under the implementation of the RMP is consistent with NMFS' standards.

In summary for those management units for which NMFS has derived rebuilding exploitation rates, a portion of, or the entire range of the anticipated total exploitation rates under the implementation of the RMP exceeds the NMFS-derived rebuilding exploitation rate for three populations (Lower Sauk River, Lower Skagit River, and the Skykomish River populations) and the two populations within the Nooksack Management Unit (North Fork Nooksack River and South Fork Nooksack River populations). In these populations, there is a decreased probability that the populations will rebuild within 25 years and/or an increase in the probability that the population will fall below their critical thresholds during that same 25-year period, when compared to the NMFS-derived rebuilding exploitation rates as the standard. Additional discussion on the identified elevated level of risk to these populations under the implementation of the RMP, in regards to the likelihood of survival and recovery of the ESU, will be provided in Section (b)(4)(i)(D).

Management Units for which NMFS-derived Rebuilding Exploitation Rate standards are not available:

The following analysis addresses the eight management units for which NMFS has not yet derived a rebuilding exploitation rate. The RMP has identified escapement objectives or maximum exploitation rates for each of these management units. These eight management units are the Lake Washington, Puyallup, White River, Nisqually, Skokomish, Mid-Hood Canal, Dungeness, and Elwha Management Units. In these management units, adequate data were not available to assess current productivity of the population(s) or NMFS has not yet completed an analysis of an appropriate rebuilding exploitation rate.

The order of the management units to be evaluated will be based on how the management unit is proposed to be managed, as outlined below. The co-managers propose to manage the Nisqually and the Skokomish Management Units in-season for escapement objectives. The RMP proposes that two management units be managed based on a pre-terminal SUS rebuilding exploitation rate (Lake Washington and Mid-Hood Canal Management Units), two management units by a SUS rebuilding exploitation rate (Dungeness, and Elwha Management Units), and two management units based on a total rebuilding exploitation rate (Puyallup and White River Management Units).

Nisqually Management Unit - The Nisqually Management Unit contains one population, the Nisqually River population (Category 2). The natural component of the Nisqually River population has exhibited an increasing escapement trend (see Table 9). Analysis of habitat capacity by the co-managers, using the Ecosystems Diagnosis and Treatment methodology (NCRT 2001 as cited in the RMP) suggests that optimum productivity under current habitat conditions is achieved by an escapement of 1,100 fish (see page 170 of the RMP).

The 1999 to 2002 average escapement of 1,318 for the Nisqually River population has been above the co-managers' escapement goal of 1,100 fish (see Table 8). Since listing, the co-managers have successfully achieved the escapement goal of 1,100 fish in the Nisqually River in all but one year (see Table 6). In 2001, the estimated natural spawning escapement in the Nisqually River was 1,079 fish, only slightly below the escapement goal.

The co-managers propose to manage the Nisqually Management Unit's terminal area fisheries based on an in-season run-size abundance update, which is designed to achieve the escapement goal of 1,100 fish (see pages 170 and 171 of the RMP). When the in-season run-size abundance estimate indicates that the RMP's upper management threshold of 1,100 fish will not be achieved with scheduled or proposed terminal area fisheries, the co-managers will constrain the fisheries with the objective of increasing abundance to a level at or above the escapement objective. The modeled anticipated range of total exploitation rates for the Nisqually Management Unit under the implementation of the RMP are the highest of any management unit, 64 to 76 percent. The most likely exploitation within this range is 76 percent (see Table 14).

Modeling of the Nisqually Management Unit indicates that the co-managers will continue to achieve the escapement goal of 1,100 fish under the implementation of the RMP. Based on the current abundance status, the increasing escapement trend for the Nisqually River population and the anticipated level of escapement under the implementation of the RMP, the level of risk to the Nisqually River population due to the anticipated range of total exploitation rates is consistent with NMFS' standards.

Skokomish Management Unit – The Skokomish Management Unit contains one population, the Skokomish River population (Category 2). The 1999 to 2002 average natural spawning escapement of 1,483 fish for the Skokomish River population has been below the RMP's escapement goal of 1,650 fish, but above the RMP's low abundance threshold of 800 fish (see

Table 2). Since listing, the natural component of the Skokomish River population has exhibited an increasing escapement trend (see Table 9).

The co-managers propose to manage the Skokomish Management Unit by applying a 15 percent pre-terminal SUS rebuilding exploitation rate and a 12 percent pre-terminal SUS critical exploitation rate ceiling (see Table 2). The Skokomish Management Unit upper management threshold is 3,650 fish. The upper escapement objective represents a spawner requirement for 1,650 in-stream natural spawners (HCSMP 1985) and 2,000 spawners required for the maintenance of hatchery production.

If the returning abundance is insufficient to achieve the upper escapement goal of 3,650 fish, as described above, or if the naturally spawning component of Skokomish River population is expected to fall below 1,200 spawners, additional terminal fishery management measures will be applied by the co-managers, with the objective of meeting or exceeding the 1,200 in-stream natural spawners (see page 175 of the RMP). The types of additional terminal management measures the co-managers will consider are provided on page 175 of the RMP. Since 1996, the annual natural escapement into the Skokomish River has exceeded 1,200 fish (see Table 6).

The anticipated range of total exploitation rates for the Skokomish Management Unit under the implementation of the RMP is 45 to 63 percent. The most likely total exploitation rate within this range is 63 percent (see Table 14). Modeling of the Skokomish Management Unit also indicates the returning abundance will be insufficient to achieve the upper escapement goal of 3,650 fish, but that the co-managers will continue to meet or exceed the lower in-stream natural spawner escapement goal of 1,200 fish under the implementation of the RMP. The RMP's escapement goal of 1,200 fish is similar to the VSP generic guidance of 1,250 fish for a viable threshold for this population.

Based on the current status, the increasing escapement trend of the population, and the anticipated level of escapement under the implementation of the RMP, the level of risk to the Skokomish River population due to the anticipated range of exploitation rates under the implementation of the RMP is consistent with NMFS' standards.

Lake Washington Management Unit - The Lake Washington Management Unit contains two populations; the Cedar River (Category 1) and the Sammamish River (Category 2). The 1999 to 2002 average escapement is 385 for the Cedar River population and 373 for the Sammamish River population (see Table 8). Since 1998, the natural escapements for both of these populations has exceeded the VSP generic guidance of 200 fish, but are well below the VSP-derived guidance for a viable threshold of 1,250 fish. Since listing, the escapement for the Cedar River population is considered stable, while the Sammamish River population is considered increasing (see Table 9).

The co-managers propose to manage the Lake Washington Management Unit by applying a 15 percent pre-terminal SUS rebuilding exploitation rate and a 12 percent pre-terminal SUS critical exploitation rate ceiling (see Table 2). The terminal area fisheries for sockeye and coho salmon will be managed "to minimize incidental impact[s] on chinook [salmon]" as long as the Cedar River population remains below the RMP's upper management threshold of 1,200 fish (see page

155 of the RMP). Appendix C: Minimum Fisheries Regime of the RMP presents the terminal conservation management measures the co-managers will impose if the Cedar River population falls below its low abundance threshold of 200 fish. These terminal conservation management measures include non-retention in recreational fisheries, no directed fisheries, and the reduction in incidental impacts by other fisheries through time and area restrictions (see pages 204 and 205 of the RMP). The Cedar River and Sammamish River populations share the same terminal fisheries. Terminal conservation management measures directed at migrating fish returning to the Cedar River will also benefit fish returning to the Sammamish River.

The anticipated range of total exploitation rates for the Lake Washington Management Unit under the implementation of the RMP is 31 to 38 percent. The most likely total exploitation rate within this range is 35 percent (see Table 14). Modeling of the Lake Washington Management Unit indicates that the co-managers will continue to meet or exceed the critical threshold of 200 natural spawners for each of these two populations under the implementation of the RMP. The range of anticipated escapements for both the Cedar River and the Sammamish River under the implementation of the RMP is 214 to 305 fish each (see Table 3). The most likely escapement for both populations within this range is 295 fish each (see Table 5).

However, as mentioned earlier, the escapement estimates for the Cedar River are based on an expansion of the observed live count of fish. Expansions of the Cedar River redd counts suggests that the expansion of the Cedar River live count may be a conservative estimate of the total escapement (P. Hage, Muckleshoot Tribe, e-mail to S. Bishop, NMFS, February 10, 2004). Additionally, escapement estimates presented in Table 6 for the Sammamish River population do not include escapement into the Upper Cottage Lake or Issaquah Creeks. Therefore, although the escapement information present in Table 6 is believed to be representative of this population’s abundance trend, the escapement estimates are to be considered a conservative estimate of the total Sammamish River population’s escapement.

The range of anticipated escapements in each watershed, although conservative estimates, suggest that escapement will be well below the VSP-derived viable threshold of 1,250 fish and perhaps approaching the VSP-derived critical threshold of 200 fish. Concerns do exist that these two populations may fall below their critical thresholds. Additional discussions on the increased concern for these populations, in regards to the likelihood of survival and recovery of the ESU, will be provided in the following section, Section (b)(4)(i)(D).

Mid-Hood Canal Management Unit - The Mid-Hood Canal Management Unit includes chinook salmon spawning aggregations in the Hamma Hamma, Duckabush, and the Dosewallips Rivers. The Mid-Hood Canal rivers population is classified as a Category 2 population (see Table 7). The 1999 to 2002 average escapement of 404 for the Mid-Hood Canal Management Unit is slightly above the co-managers’ low abundance threshold of 400 fish, but well below the viable threshold of 1,250 fish derived from VSP guidance (see Table 9). Since listing, the Mid-Hood Canal rivers population has exhibited an increasing escapement trend (see Table 9), although trends in individual spawning aggregates of the population are varied (see Table 12).

The co-managers propose to manage the Mid-Hood Canal Management Unit by applying a 15 percent pre-terminal SUS rebuilding exploitation rate and a 12 percent pre-terminal SUS critical exploitation rate ceiling (see Table 2). Additionally, the co-managers propose that when the Mid-Hood Canal Management Unit's upper management threshold of 750 spawners is not expected to be met, that all extreme terminal (freshwater) fisheries that are likely to impact adult spawners of these "sub-populations" will be closed (see page 180 of the RMP).

If escapement is projected to fall below the Mid-Hood Canal Management Unit's low abundance threshold of 400 fish, the co-managers will implement "further conservation measures" in pre-terminal and terminal fisheries to reduce mortality (see page 180 of the RMP). These terminal conservation management measures include non-retention, or even closures of recreational fisheries, no directed fisheries, and the reduction in incidental impacts in other fisheries by the use of time and area restrictions (see pages 207 and 208 of the RMP). The anticipated range of the total exploitation rates for the Mid-Hood Canal Management Unit, including those from Canadian fisheries, under the implementation of the RMP is 26 to 34 percent. The most likely total exploitation rate within this range is 32 percent (see Table 14).

Terminal-area harvest impacts have been virtually eliminated for the Mid-Hood Canal rivers chinook salmon population, particularly when abundance is below the RMP's low abundance threshold. It is anticipated that the pre-terminal SUS fisheries, with a most likely exploitation rate of 12 percent, will account for most of the exploitation rate for the entire SUS of 13 percent (see Table 5). The impacts in pre-terminal SUS fisheries is limited to no more than a 15 percent exploitation rate when the anticipated escapement abundance exceeds the RMP's low abundance threshold. When the anticipated abundance is less than the RMP's low abundance threshold, the impacts in pre-terminal SUS fisheries is reduced to no more than 12 percent.

Since 1990, escapements to the natural spawning areas in Mid-Hood Canal have exceeded the RMP's low abundance threshold of 400 fish for this management unit in only two years (see Table 6). Estimated escapements were 762 fish and 438 fish in 1999 and 2000, respectively. In 2002, the natural escapement into the Mid-Hood Canal Management Unit of 95 spawners is well below the VSP guidance for a critical threshold of 200 fish.

The range of anticipated aggregate spawning escapements into the rivers of the Mid-Hood Canal Management Unit under the implementation of the RMP is 344 to 531 fish (see Table 3). The most likely escapement within in this range is 504 fish (see Table 5). As mentioned earlier, the co-managers, in cooperation with NMFS, have modeled escapement results under a no Puget Sound fishery alternative. The most likely escapement under the "no fishery" scenario is 527 fish. Under the "no fishery" alternative, when compared to the proposed RMP, the most likely resultant escapement into the Mid-Hood Canal population would increase by only 23 fish, from 504 to 527 fish.

Simulation modeling of the Mid-Hood Canal Management Unit indicates that the co-managers will continue to meet or exceed the critical threshold of 200 natural spawners during the implementation of the RMP from May 1, 2005 through April 2010. However, given that the range of anticipated escapements approaches the VSP-derived critical threshold of 200 fish, and issues regarding the spatial distribution of the escapement discussed earlier (see pages 40 to 42), concerns do exist for Mid-Hood Canal rivers population. Additional discussion on the increased concern for the Mid-Hood Canal rivers population in regards to the likelihood of survival and recovery of the ESU will be provided in the following section, Section (b)(4)(i)(D).

Dungeness Management Unit - The Dungeness Management Unit contains one population, the Dungeness River population (Category 1). The 1999 to 2002 average escapement of 345 fish for Dungeness River population has been above the VSP-derived critical threshold of 200 fish, but below the RMP's low abundance threshold of 500 fish (see Table 9). Since listing, the Dungeness River population has exhibited an increasing escapement trend (see Table 9).

The co-managers propose to manage the Dungeness Management Unit by applying a 10 percent SUS rebuilding exploitation rate and a 6 percent SUS critical exploitation rate ceiling (see Table 2). The RMP's SUS rebuilding exploitation rate and the SUS critical exploitation rate ceiling do not include impacts in Alaska and Canadian fisheries. In recent years, Alaska and Canadian fisheries have accounted for the vast majority of the impacts on the Dungeness Management Unit. Although there are no estimates for the Dungeness Management Unit, in the adjacent Elwha Management Unit, it is estimated that the Alaska and Canadian harvests represented, on average (1993 to 1997), 75 percent of the total impacts (16.2 percent in Alaska plus 58.8 percent in Canada, see page 185 of the RMP). A similar Alaska and Canadian harvest distribution is likely for the Dungeness River population.

The co-managers' stated management objective in the RMP for the Dungeness Management Unit is "to stabilize escapement and recruitment, as well as to restore the natural-origin recruit population basis through supplementation and fishery restrictions" (see page 182 of the RMP). The co-managers, in cooperation with federal agencies and private-sector conservation groups, have implemented a supplementation program to rehabilitate chinook salmon runs in the Dungeness River. Chinook salmon from the hatchery program on the Dungeness River are listed under the ESA. The primary goal of the supplementation and fishery control program is to increase the number of fish spawning naturally in the river, while maintaining the generic characteristics of the existing stock.

Simulation modeling indicates the range of total exploitation rates that may be anticipated for the Dungeness Management Unit under the implementation of the RMP is 22 to 29 percent. The most likely total exploitation rate within this range is 27 percent (see Table 14). However, the anticipated SUS exploitation rate for the entire SUS fishery affecting this population is most likely only 5 percent (see Table 5). The range of anticipated escapements to the Dungeness River resulting from the implementation of the RMP is 231 to 356 fish (see Table 3). The most likely escapement within this range is 336 fish (see Table 5). The anticipated escapement range is below the RMP's low abundance threshold of 500 fish, and approaches the VSP-derived critical threshold of 200 fish for this population.

Simulation modeling of the Dungeness Management Unit indicates that the VSP-derived critical threshold of 200 natural spawners will continue to be met or exceeded under the implementation of the RMP from May 1, 2005 through April 2010. However, given that the range of anticipated escapements approaches the critical threshold of 200 fish and falls below the RMP's low abundance threshold of 500 fish, concerns do exist for this population. Benefits to this population by reductions in SUS fishery-related impacts are limited. The anticipated SUS exploitation rate on this population is very low, at 5 percent. Additional discussion on the increased concern for this population in regards to the likelihood of survival and recovery of the ESU will be provided in Section (b)(4)(i)(D).

Elwha Management Unit - The Elwha Management Unit contains one population, the Elwha River population (Category 1). The 1999 to 2002 average escapement of 2,009 for the Elwha River population has been above the RMP's low abundance threshold of 1,000 fish. The Elwha River population has exhibited a stable escapement trend since listing (see Table 9).

The co-managers propose to manage the Elwha Management Unit with a 10 percent SUS rebuilding exploitation rate and a 6 percent SUS critical exploitation rate ceiling (see Table 2). The RMP's SUS rebuilding exploitation rate and the SUS critical exploitation rate ceiling do not include impacts in Alaska and Canadian fisheries. Alaska and Canadian fisheries have accounted for the majority of the impacts on the Elwha Management Unit. On average (1993 to 1997), 75 percent of the impacts on the Elwha River population have occurred in Alaska and Canadian fisheries (see page 185 of the RMP).

In the Elwha River, chinook salmon production is limited by two hydroelectric dams which block access at river mile 5 to approximately 70 miles of upstream spawning and rearing habitat (T. Tynan, NMFS, pers. com., to K. Schultz, NMFS, February 18, 2004). Habitat below the dams is also severely degraded because of downstream effects of the dams (N. Lampsakis, Point-No-Point Treaty Council, pers. com., to K. Schultz, NMFS, February 20, 2004). Recovery of this population is dependent upon removal of the two dams, and restoration of access to high quality habitat in the upper Elwha River basin. Chinook salmon produced by the hatchery mitigation program in the Elwha River system are considered essential to the recovery, and are listed under the ESA.

The anticipated range of total exploitation rates for the Elwha Management Unit under the implementation of the RMP is 22 to 30 percent. The most likely total exploitation rate within this range is 27 percent (see Table 14). Similar to the Dungeness Management Unit, the most likely exploitation rate for the SUS fisheries on the Elwha River population is only 5 percent (see Table 5). The resulting range of anticipated escapements to the Elwha River under the implementation of the RMP is 1,395 to 2,125 fish (see Table 3). The range of anticipated escapements is above the RMP's low abundance threshold of 1,000 fish, but below the co-managers' upper management threshold of 2,900 fish.

Based on the current status and stable escapement trend of the population, the anticipated level of escapement under the implementation of the RMP, the hatchery mitigation program initiated on the Elwha River, and consideration of the low anticipated SUS exploitation rate, the level of risk to the Elwha River population due to the anticipated range of exploitation rates under the implementation of the RMP is consistent with NMFS' standard for rebuilding.

Puyallup Management Unit - The Puyallup Management Unit contains one population. The Puyallup River population is classified as a Category 2 population. Hatchery programs introduced out-of-basin origin stocks, primarily of Green River lineage, into the Puyallup River system beginning in 1917 (T. Tynan, NMFS, pers. com., to K. Schultz, NMFS, February 10, 2004). The 1999 to 2002 average escapement of 1,672 fish for Puyallup River population has been well above the RMP's low abundance threshold of 500 fish and above the VSP-derived viable threshold of 1,250 fish (see Table 9). Using the trend in the South Prairie Creek index area as a proxy, the Puyallup River population is considered to have a stable escapement trend (see Table 9).

The co-managers propose to manage the Puyallup Management Unit by applying a 50 percent rebuilding exploitation rate and a 12 percent pre-terminal SUS critical exploitation rate ceiling. The resulting anticipated range of total exploitation rates for the Puyallup Management Unit under the implementation of the RMP is expected to be 49 to 50 percent. The most likely total exploitation rate within this range is 50 percent (see Table 14). The range of anticipated escapements to the Puyallup River under the implementation of the RMP is 1,798 to 2,419 fish (see Table 3). The most likely escapement within this range is 2,419 fish (see Table 5). The range of anticipated escapements for the Puyallup River is above the VSP-derived viable threshold of 1,250 fish.

Based on the current status, the stable escapement trend, and the anticipated level of escapement to remain above the viable threshold, the level of risk to the Puyallup River population due to the anticipated range of exploitation rates under the implementation of the RMP is consistent with NMFS' standard for rebuilding.

White River Management Unit – The White River Management Unit contains one population, the White River population (Category 1). The 1999 to 2002 average escapement of 1,220 fish for White River population has been above the RMP's upper management threshold of 1,000 fish (see Table 9). The White River population has exhibited an increasing escapement trend since listing (see Table 9).

The co-managers propose to manage the White River Management Unit by applying a 20 percent total rebuilding exploitation rate and a 15 percent SUS critical exploitation rate ceiling. The resulting anticipated range of total exploitation rates for the White River Management Unit under the implementation of the RMP is expected to vary little around the RMP's 20 percent rebuilding exploitation rate (see Table 14). The range of anticipated escapements to the White River under the implementation of the RMP is 1,011 to 1,468 fish (see Table 3). The most likely escapement within this range is 1,459 fish (see Table 5). Modeling suggests that escapement will continue to remain above the RMP's upper management threshold of 1,000 fish under the implementation of the RMP.

Based on the current status and increasing escapement trend of the of the population, and the anticipated level of escapement under the implementation of the RMP, the level of risk to the White River population due to the anticipated range of exploitation rates under the implementation of the RMP is consistent with NMFS' standard for rebuilding.

In summary, for those management units where adequate data were not available for NMFS to develop rebuilding exploitation rates, or for those management units where NMFS has yet to develop a rebuilding exploitation rate, there is an increased level of concern for the Cedar River, Sammamish River, Mid-Hood Canal rivers, and Dungeness River populations due to the low escapement anticipated under the implementation of the RMP. Additional discussion on the increased concern for these populations, in regards to the likelihood of survival and recovery of the ESU, will be provided in the following section.

(6) Section (b)(4)(i)(D) Displays a biologically based rationale demonstrating that the harvest management strategy will not appreciably reduce the likelihood of survival and recovery of the Evolutionarily Significant Unit in the wild, over the entire period of time the proposed harvest management strategy affects the population, including effects reasonably certain to occur after the proposed actions cease.

The Puget Sound TRT is in the process of developing recommended recovery biological criteria for listed salmonids in the Puget Sound region. The TRT has prepared a draft document that includes general guidelines for assessing recovery efforts across individual populations within Puget Sound and determining whether they are sufficient for delisting and recovery of the listed ESU (NMFS 2002a). The preliminary delisting and recovery criteria recommendation provided by the TRT (see Chapter 3 in NMFS 2002d) have been used to assist in the evaluation of the harvest management strategy represented by the RMP.

Although component populations contribute fundamentally to the structure and diversity of the ESU, it is the ESU, not an individual population, which is the listed “species” under the ESA. The TRT is charged with identifying the biological characteristics of a recovered ESU as part of developing delisting and recovery criteria. These biological characteristics are based on the collective viability of the individual populations, their characteristics, and their distributions throughout the ESU.

NMFS recognizes that there are various recovery scenarios that may lead to a recovered ESU. Different scenarios of ESU recovery may be based on choosing different degrees of acceptable risk of extinction for different combinations of populations across the ESU. An ESU-wide scenario with all populations at the lower end of the planning range for viability is unlikely to assure persistence and delisting of the ESU (NMFS 2002a). The final ESU-wide scenario for delisting will likely include populations with a range of risk levels, but when considered in the aggregate, the collective risk will be sufficiently low to assure persistence of the ESU.

The geographical distribution of viable populations across the Puget Sound Chinook Salmon ESU is important for the ESU’s recovery (NMFS 2002a). The TRT has identified five geographic regions (Figure 7) within the Puget Sound Chinook Salmon ESU based on similarities in hydrographic, biogeographic, and geologic characteristics, which also correspond to regions where groups of populations could be affected similarly by catastrophes (volcanic events, earthquakes, oil spills, etc.). An ESU with well-distributed viable populations avoids the situation where populations succumb to the same catastrophic risk(s), allows for a greater potential source of diverse populations for recovery in a variety of environments (i.e., greater options for recovery), and will increase the likelihood of the ESU’s survival in response to rapid environmental changes, such as a volcano eruption of Mount Rainier. Geographically diverse populations in different regions also distribute the ecological and ecosystem services provided by salmon across the ESU.

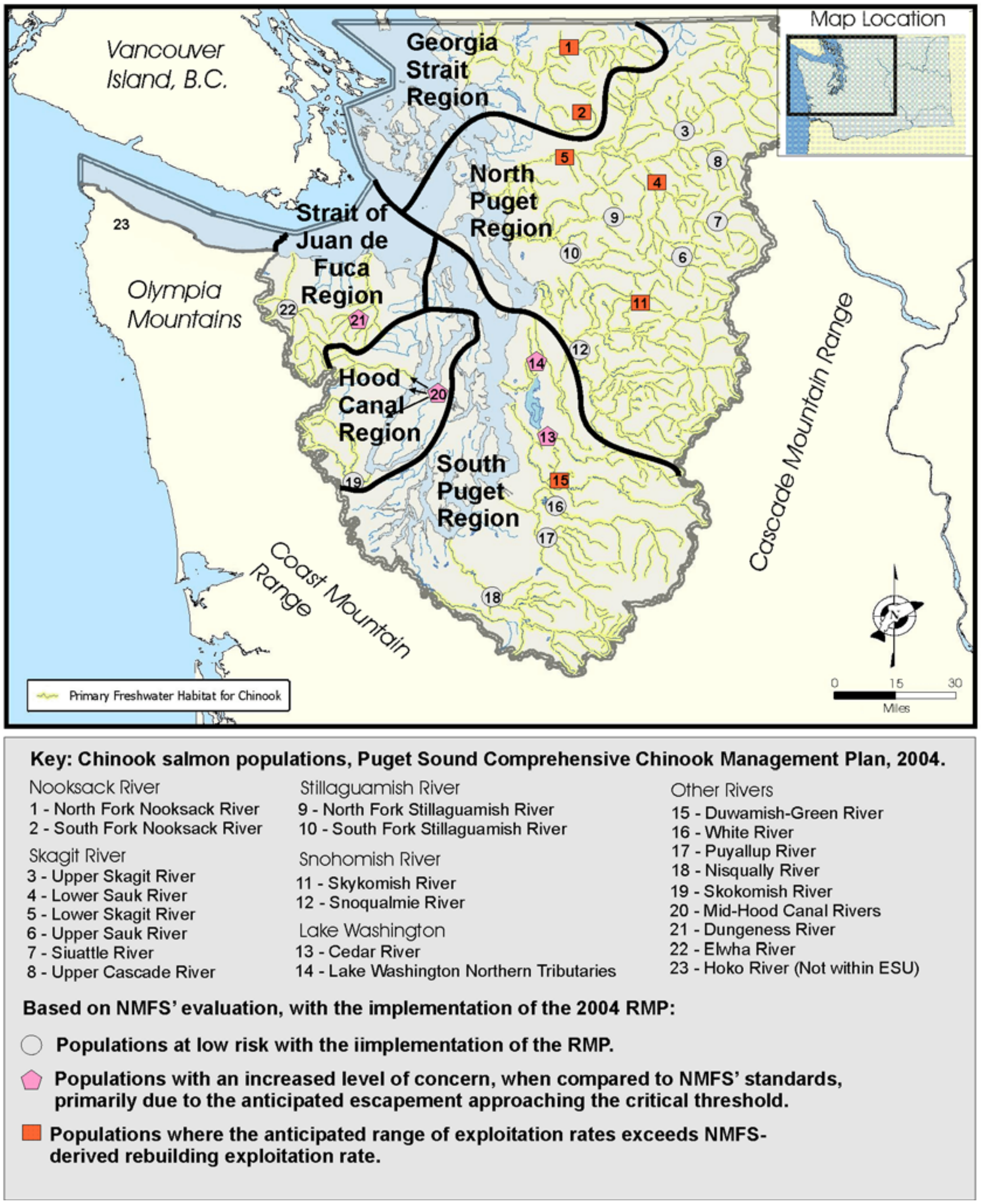


Figure 7. Map of the geographic regions within the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU). Based on NMFS' proposed evaluation, identified within the figure are populations are with an increased level of concern, when compared to NMFS' standards and populations where the anticipated range of exploitation rates resulting from the implementation of the RMP exceeds the NMFS-derived rebuilding exploitation rates.

The TRT recommends that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of the five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (NMFS 2002a). An ESU-wide recovery scenario should also include within each of these geographic regions one or more viable populations from each major genetic and life history group historically present within that geographic region (NMFS 2002a). While changes in harvest alone cannot recover the Puget Sound Chinook Salmon ESU, NMFS can use the preliminary TRT guidance for assistance in evaluating whether the proposed RMP would impede recovery of the ESU.

The following risk assessment is presented in two stages. In the first stage, a potential area of concern or risk is identified by region. In the second stage, the likelihood of that concern or risk occurring is evaluated. The assessment in the second stage also considers the practical influence harvest may have on the potential concern or risk.

Estimated impacts from the fisheries proposed by the RMP will vary by region, consistent with population-specific management objectives specified in the RMP. In prior sections, NMFS evaluated the RMP's impacts on individual populations. Consistent with the TRT's guidance to assess ESU-wide effects, the following is an evaluation of the estimated impacts on the ESU, by region, from the fisheries proposed by the RMP:

Georgia Strait Region – Chinook salmon originating from the Georgia Strait Region are distinct from other Puget Sound chinook salmon in their genetic attributes, life history traits, and habitat characteristics (PSTRT 2003). There are two populations within the Georgia Strait Region: the North Fork Nooksack River and the South Fork Nooksack River populations (see Figure 7). Both populations are designated as Category 1 populations (see Table 7). Straying between the two populations was historically low, as supported by available genetic data, but straying may have increased in recent years (PSTRT 2003). The more recent straying observations may be partially due to an increase in hatchery production. This potential source of straying may have been reduced by the co-managers with the implementation of a 50 percent reduction in on-station hatchery releases from Kendall Creek Hatchery (T. Scott, WDFW, e-mail to K. Schultz, NMFS, March 22, 2004). Habitat differences between the two populations exist, but are subtle (PSTRT 2003).

In previous sections, NMFS has evaluated the RMP's impacts on individual populations and identified an elevated level of risks to the North Fork Nooksack River and South Fork Nooksack River populations, when compared to NMFS' standards. A summary of the risk analysis for these two populations follows. A more detailed analysis of risks to these populations is provided in previous sections.

Nooksack River Populations - The North Fork Nooksack River natural-origin population has exhibited an increasing escapement trend since listing (see Table 9). However, the estimated 1999 to 2002 average escapement of 180 natural-origin spawners for the North Fork Nooksack River population is below the NMFS-derived critical threshold of 200 fish (see Table 8). The South Fork Nooksack River natural-origin population has also exhibited an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 249 natural-origin spawners for the South Fork Nooksack River population is slightly above the NMFS-derived critical threshold of 200 fish (see Table 8).

The broodstock used for the Kendall Creek Hatchery program, located on the North Fork Nooksack River, retains the genetic characteristics of the wild population and is considered essential for the survival and recovery of the ESU. When including Kendall Creek hatchery-origin fish, an average aggregate escapement of 3,438 natural spawners in the North Fork Nooksack River has been observed since listing (see Table 10). Adult fish produced by the Kendall Creek Hatchery program and migrating with the natural-origin fish are expected to buffer harvest-induced genetic and demographic risks to the natural-origin North Fork Nooksack River population (see discussion on pages 27 to 30).

Increased escapement of natural-origin fish into the Nooksack River in recent years may be due, in part, to harvest reductions. However, the abundance trend in the natural-origin returns suggests that, although escapement may be stable or even trend upward toward or above the optimum level associated with current habitat condition, natural-origin recruitment will not increase much beyond that level unless constraints limiting marine, freshwater, and estuary survival are alleviated. Augmentation of these natural-origin spawners on the natural spawning areas of the North Fork Nooksack River, with the addition of hatchery-origin spawners, will continue to test the natural production potential of the system at higher escapement levels. The escapement of hatchery-origin fish may also benefit the natural-origin production by capitalizing on favorable survival conditions in some years.

For the Nooksack Management Unit, the anticipated range of total exploitation rates is 20 to 26 percent. The most likely total exploitation rate within this range is 25 percent (see Table 14). Similar to recent years, the largest proportion of the total exploitation rate is expected to be accounted for by the Canadian fisheries (see Table 4). The SUS exploitation rate on the Nooksack River populations is not anticipated to exceed 7 percent under the proposed RMP (see Table 3). Even if the entire SUS exploitation rate on Nooksack River populations of 7 percent was eliminated, the NMFS-derived rebuilding exploitation rate of 12 percent for the Nooksack Management Unit would still not be achieved.

NMFS has evaluated the elevated risks to the Nooksack Management Unit associated with the SUS fisheries proposed in the RMP, using the NMFS-derived rebuilding exploitation rate as the standard for comparison. With the modeled Canadian fisheries, and assuming 2003 abundance, a 7 percent SUS fishery exploitation rate for the Nooksack River populations would lead to a 6 percentage point decrease in the probability of rebuilt populations in 25 years under current conditions. Modeling also suggests that the application of a 7 percent SUS fishery exploitation rate would result in a 14 percentage point increase in the probability that the populations will fall below the critical level during that same 25-year period (see Table 16).

Similar to recent years, it is likely that the vast majority of the SUS fishery harvest impacts on the Nooksack Management Unit populations under the RMP would occur in treaty Indian fisheries. Since 2001, the majority of the SUS harvest on the Nooksack Management Unit has occurred in tribal fisheries. In recognition of tribal management authority and the Federal government’s trust responsibility to the tribes, NMFS is committed to considering their judgment and expertise regarding the conservation of trust resources. Consistent with this commitment and as a matter of policy, NMFS has sought, where there is appropriate tribal management, to work with tribal managers to provide limited tribal fishery opportunities, so long as the risk to the population remains within acceptable limits.

Trends in the escapement of natural-origin Nooksack early chinook salmon populations are increasing. The additional contributions of hatchery origin spawners to the natural spawning areas are anticipated to reduce catastrophic and demographic risks to the North Fork Nooksack population. In addition, the Kendall Creek hatchery-origin chinook salmon share the ecological and genetic characteristics of the natural origin spawners. Information suggests that past harvest constraints have had limited effect on increasing the escapement of returning natural-origin fish. The magnitude of Canadian harvest is expected to significantly exceed the NMFS-derived rebuilding exploitation rate for the Nooksack River populations. However, the SUS exploitation rate on the Nooksack River populations is not anticipated to exceed 7 percent. NMFS considers the tribes' management authority, judgment, and expertise regarding conservation of trust resources. Taking all these factors into account, NMFS concludes that the implementation of the RMP from May 1, 2005 through April 30, 2010, will adequately protect chinook salmon populations in the Georgia Straight Region.

North Puget Sound Region – The largest river systems in Puget Sound are found within the North Puget Sound Region. There are ten chinook salmon populations delineated by the TRT within the North Puget Sound Region (see Figure 7). NMFS has determined that the proposed RMP will contribute to the rebuilding of seven of the ten populations (70 percent) within this region. NMFS has identified a potential elevated level of risk under the RMP for three of these ten populations, as assessed through a comparison of likely exploitation rate ranges for these populations under the RMP with their NMFS-derived rebuilding exploitation rates. These three populations are the lower Sauk River and lower Skagit River populations in the Skagit Summer/Fall Management Unit, and the Skykomish River population in the Snohomish Management Unit. A summary of the risk analysis for these three populations follows, but a more detailed analysis is provided in previous sections.

Lower Skagit River Population: The lower Skagit River population is classified as a Category 1 population (see Table 7). The population has shown an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 2,944 fish has been above the NMFS-derived viable threshold of 2,182 fish for the lower Skagit River population (see Table 8). The anticipated escapement under the implementation of the RMP for the lower Skagit River population is 1,182 fish (see Table 5). This level of escapement is well above the NMFS-derived critical threshold of 251 fish for the lower Skagit River population.

The anticipated total exploitation rate under the implementation of the RMP for the lower Skagit River population would range between 48 and 56 percent. The most likely total exploitation rate within this range would be 55 percent (see Table 14). The upper end of the range of anticipated total exploitation rates exceeds the NMFS-derived rebuilding exploitation rate of 49 percent for this population. Similar to recent years, it is anticipated that Canadian fisheries will account for the substantial portion of the anticipated total exploitation rate on this population under the implementation of the RMP (see Table 4).

The anticipated range of exploitation rates for the SUS fisheries for the lower Skagit River population is 16 to 18 percent (see Table 3). The most likely exploitation rate for the SUS fisheries within this range is 16 percent (see Table 5). Through modeling, NMFS assessed the increased risk to the lower Skagit River population associated with the SUS fisheries proposed in the RMP. With the modeled Canadian fisheries and abundance similar to 2003 levels, a 16 percent SUS exploitation rate would result in a 26 percentage point decrease in the probability of a rebuilt population in 25 years under current conditions. This modeling also indicates that there is no change in the probability that the population will fall below the critical level during that same 25-year period (see Table 16).

Lower Sauk River Population: The lower Sauk River chinook salmon population is classified as a Category 1 population (see Table 7). The population has exhibited an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 721 fish has been above the NMFS-derived viable threshold of 681 fish for the lower Sauk River population (see Table 8). The most likely escapement resulting from the implementation of the RMP for the lower Sauk River population is 588 fish (see Table 5). This level of escapement is above the NMFS-derived critical threshold of 200 fish defined for the for the lower Sauk River population (see Table 8).

Total exploitation rates on the lower Sauk River population under the implementation of the RMP on the lower Sauk River population are expected to range between 48 and 56 percent. The most likely total exploitation rate within this range is 55 percent (see Table 14). The upper end of the range of anticipated total exploitation rates exceeds the NMFS-derived rebuilding exploitation rate for this population of 51 percent. A lack of data prevented NMFS from determining the level of increased risk for to the lower Sauk River population in the event that the total exploitation rate exceeds the NMFS-derived rebuilding exploitation rate. The effects of the implementation of the RMP on the lower Sauk River population are assumed to be similar to those identified for the lower Skagit River population as discussed above.

Skykomish River Population: The Skykomish River chinook salmon population is classified as a Category 1 population (see Table 7). The population has exhibited an increasing escapement trend since listing (see Table 9). The 1999 to 2002 average escapement of 2,118 fish for the Skykomish River population has been above the NMFS-derived critical threshold of 1,650 fish, but below the NMFS-derived viable threshold of 3,500 fish (see Table 8). The estimated escapement for the Skykomish River population that is most likely to result from the implementation of the RMP is 2,385 fish (see Table 5).

The total exploitation rate of 22 percent that is most likely to result from the implementation of the RMP would exceed the NMFS-derived rebuilding exploitation rate for the Skykomish River population by 5 percentage points (see Table 19). The anticipated harvest impacts on the populations within the Snohomish Management Unit include those from Canadian fisheries (see Table 4). The management of Canadian fisheries is outside the jurisdiction of the co-managers. However, the co-managers do have jurisdiction over fisheries occurring within the SUS areas. For the Snohomish Management Unit, the anticipated range of exploitation rates for the SUS fisheries is 13 to 14 percent (see Table 3). The most likely exploitation rate within in this range is 13 percent (see Table 5).

Through modeling, NMFS identified the increased level of risk that may be associated with the SUS fisheries exploitation rates proposed in the RMP, when compared to the NMFS-derived rebuilding exploitation rate. Under the mostly likely scenario, a 13 percent SUS exploitation rate for the Skykomish River population will result in a 14 percentage point decrease in the probability of a rebuilt population in 25 years under current conditions. Modeling also suggests that the implementation of the RMP will result in a 3 percentage point increase in the probability that the population will fall below the critical level during that same 25-year period (see Table 16).

The TRT recommends that any ESU-wide recovery scenario include at least two to four viable chinook salmon populations in each of the five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region. NMFS' assessment is that the RMP will contribute to rebuilding for seven of the ten populations within the North Puget Sound Region. The life history and run timing characteristics of the three populations identified as having an elevated level of risk for rebuilding (the lower Sauk River, the lower Skagit River, and the Skykomish River populations), are similar to the seven other populations in the region (see Table 7). Two of these three "at risk" populations are currently above their identified viable thresholds, and all three populations have an increasing trend in escapement since listing. Therefore, NMFS concludes that the RMP's management objectives are adequately protective of the geographic distribution, life history characteristics, and diversity of populations within the North Puget Sound Region of the ESU.

South Puget Sound Region – There are six populations delineated by the Puget Sound TRT within the South Puget Sound Region (see Figure 7). Genetically, most of the present spawning aggregations in the South Puget Sound Region are similar, likely reflecting the extensive influence of transplanted stock hatchery releases, primarily from the Green River population (PSTRT 2003). The TRT found that life history and genetic variations were not useful in determining populations within the South Puget Sound Region. Most chinook salmon in the South Puget Sound Region have similar life history traits.

In the previous sections, NMFS found that the proposed RMP is anticipated to contribute to the stabilization or rebuilding of all populations within this region[11]. However, NMFS has identified a concern for two South Puget Sound Region populations due primarily to anticipated low abundance under the implementation of the RMP from May 1, 2005 through April 2010. A summary of the concerns for these two populations follows, but a more detailed analysis is provided in previous sections.

Cedar River and Sammamish River Populations: The Lake Washington Management Unit includes two populations; the Cedar River (Category 1) and the Sammamish River (Category 2) populations. The 1999 to 2002 four-year average escapements of 385 fish for the Cedar River population and 373 fish for the Sammamish River population are above the identified critical thresholds. The four-year average escapement of 385 fish for the Cedar River population is

[11] With the level of escapement for the Duwamish-Green River population anticipated to continue to exceed the NMFS-derived viable threshold, the level of risk to this population associated with the implementation of the RMP is consistent with NMFS' standards.

below the RMP's upper management threshold for the population of 1,200 fish (see Table 8). The RMP proposes no upper management threshold for the Sammamish River population (see discussion on pages 32 to 33).

Since listing, the trend in escapement to the Cedar River has been stable, while the escapement to the Sammamish River population has exhibited an increasing trend (see Table 9). However, it is noted that the total escapement estimates for the Cedar River, as presented in Table 6, are based on an expansion of a live fish counts. Expansions of redd counts in the Cedar River suggest that this historical expansion of the live counts may be a conservative estimate of the total escapement. Additionally, the escapement estimates for the Sammamish River population do not include escapement into the Upper Cottage Lake or Issaquah Creeks. Therefore, although the escapement information used in this evaluation is believed to be representative of trends, the escapement estimates are considered a conservative estimate of the total escapement. A direct comparison of the Cedar River and Sammamish River escapements with the VSP generic guidance for a critical threshold of 200 fish should be considered conservative, as the total escapements for these two systems are likely greater than those depicted in Table 6.

Since 1998, the estimated natural escapement levels for both populations within the Lake Washington Management Unit have exceeded the VSP generic guidance for a critical threshold of 200 fish, but have remained well below the guidance for a viable threshold of 1,250 fish. Escapements into the Cedar River and the Sammamish River tributaries resulting from the implementation of the RMP are anticipated to range from 214 to 305 fish each (see Table 3). The most likely escapement for each population within this range is 295 fish (see Table 5).

Harvest impact modeling for the Lake Washington Management Unit indicates that the co-managers will continue to meet or exceed the critical threshold of 200 natural spawners for both populations within the management unit under the implementation of the RMP. However, given that the range of anticipated escapements approaches the critical thresholds for each population, and considering the volatility in escapement observed for these populations in the past, NMFS is concerned that these populations could experience very low abundance in the next several years, below the critical thresholds. However, there is a substantial contribution of stray hatchery-origin fish to the natural escapement in the Sammamish River tributaries. The Sammamish River population (Category 2 population) is not genetically distinct from these straying hatchery-origin fish. These hatchery-origin fish may lessen demographic concerns that may arise regarding low escapement for that population.

In previous sections of this document, NMFS has expressed concern for the Sammamish River population because the RMP provides no low abundance threshold for managing harvest impacts on the population. The co-managers propose that protective measures imposed to safeguard the Cedar River population, which include management constraints that would be applied when the population falls below its low abundance threshold, will also incidentally benefit the Sammamish River population. The co-managers' argument is compelling because the Cedar River and Sammamish River populations are both affected by the same terminal area fisheries. NMFS agrees that it is reasonable to expect that terminal conservation management measures directed at migrating fish returning to the Cedar River would also benefit fish returning to the Sammamish River.

Limiting factors to chinook salmon survival and productivity in the Lake Washington basin are being addressed by improving fish passage conditions at the Ballard Locks, and restoration of anadromous fish access to 17 miles of the Cedar River above the Landsburg Dam. While these improvements will likely enhance spatial structure and productivity, there remain highly altered conditions in the Lake Washington basin and at the Ballard Locks that are daunting to juvenile salmon survival and emigration, and adult immigration.

The TRT recommends that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region. Despite potential risks that the Cedar River and Sammamish River populations may experience under the harvest management plan from May 1, 2005 through April 2010, the RMP is still expected to provide sufficient protection for four of the six populations in the South Puget Sound Region. The concerns for the Cedar River and Sammamish River populations do not represent much risk to the region. Identifying these two populations as a concern is considered a precautionary approach, as information suggests that the escapements estimated for these systems are likely conservative. NMFS believes that the RMP's management objectives are adequately protective of the geographic distribution, life history characteristics, and genetic diversity of the populations within the South Puget Sound Region of the ESU.

Hood Canal Region – Primarily because of their geographic isolation from other basins of the ESU, the TRT concluded that chinook salmon spawning historically in Hood Canal streams were independent from other chinook salmon spawning aggregations in the Puget Sound region (PSTRT 2003). There are two populations within the Hood Canal Region: the Skokomish River and the Mid-Hood Canal rivers populations (see Figure 7). Both populations are classified as a Category 2 population (see Table 7). Watersheds harboring Category 2 chinook salmon populations are areas where indigenous populations of the species are believed to no longer exist, but where sustainable wild populations existed historically and wild production remains self-sustaining at present and where habitat could still support such populations.

In a previous section, NMFS has identified potential concern for harvest impacts on the spatial structure of the Mid-Hood Canal rivers population. This concern is heightened because of the low abundance in two of the individual rivers. A summary of the concerns for the Mid-Hood Canal rivers population follows, but a more detailed analysis is provided in previous sections.

Mid-Hood Canal Rivers Population: The 1999 to 2002 average escapement of 404 fish for the Mid-Hood Canal rivers population is only slightly above the RMP's low abundance threshold of 400 fish for the population (see Table 9). The Mid-Hood Canal rivers population has exhibited an increasing escapement trend since the time of listing (see Table 9). However, low levels of escapements in the Mid-Hood Canal Management Unit are anticipated to continue under the implementation of the RMP. The range of anticipated spawning escapements into the rivers of the Mid-Hood Canal Management Unit under the implementation of the RMP from May 1, 2005 through April 2010 is expected to range from is 344 to 531 fish (see Table 3). The most likely escapement within this range is 504 fish (see Table 5).

The Mid-Hood Canal rivers population includes spawning aggregations in the Hamma Hamma, Duckabush, and the Dosewallips Rivers. Most harvest impacts on this population occur in mixed stock areas outside of the Hood Canal region. The effects of these mixed stock fisheries on the three components of the population are variable and unpredictable. It is therefore difficult for the co-managers to impose differential harvest effects on the individual spawning aggregate components in order to adjust spawning distribution among the rivers. In 2002, the natural escapement of 95 spawners into the Mid-Hood Canal Management Unit fell well below the VSP guidance for a critical threshold of 200 fish for this population. Total annual spawning escapements below 40 fish have been observed in recent years in each of the Duckabush and Dosewallips Rivers.

For the Mid-Hood Canal Management Unit, the anticipated range of total exploitation rates that would result from the implementation of the RMP is 26 to 34 percent. The most likely total exploitation rate within this range is 32 percent (see Table 14). Similar to the more northern chinook salmon management units discussed above, Canadian fisheries are expected to account for a substantial proportion of the total exploitation rate on this population (see Table 4). The most likely SUS exploitation rate anticipated under the implementation of the RMP is 13 percent.

Escapement into the individual systems has varied, with the spawning aggregation in the Hamma Hamma River representing the majority of the total Mid-Hood Canal rivers population abundance in recent years (see Table 6). Adult returns resulting from the WDFW-administered Hamma Hamma River supplementation program, which relies partially on broodstock returning to the river, has likely contributed substantially to the Mid-Hood Canal rivers population's increasing abundance trend (see Table 12).

The hatchery-origin adult fish that are progeny of broodstock collected from the Hamma Hamma River may buffer demographic risks to the Mid-Hood Canal rivers population in the short term, particularly to the component of the population spawning in the Hamma Hamma River. The general characteristics of the Mid-Hood Canal rivers population, including life history and run timing, are also found in the Skokomish River population (see Figure 7), the only other population within the region. Genetically similar stocks are also sustained by several hatchery facilities in the Hood Canal area and in hatcheries in the South Puget Sound Region where the Green River-lineage are naturally or artificially sustained.

As mentioned in a previous section, the co-managers, in cooperation with NMFS, have modeled escapement results under a no Puget Sound fishery alternative. The most likely escapement for this management unit under the "no fishery" scenario is 527 fish. With no Puget Sound fisheries, anticipated escapement into the Mid-Hood Canal rivers population would only increase by 23 fish, spread among the three component natural spawning rivers. Given the observed proportions of recent year escapements into the individual river systems comprising the Mid-Hood Canal Management Unit (see Table 12), the most likely increase in escapement into the Duckabush and Dosewallips Rivers will be only three and two fish, respectively. Based on modeling, further decreases in the proposed SUS fisheries-related impacts would have little effect on the persistence of the spawning aggregations in the Dosewallips and Duckabush Rivers.

The TRT recommends that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region. NMFS concludes the RMP's management objectives are adequately protective of the geographic, life history, and diversity of the populations within the Hood Canal Region of the ESU. This recommended determination takes into consideration that the hatchery-origin production may buffer demographic risks associated with the RMP to the Mid-Hood Canal rivers population. Additionally, the genetic similarity between the Mid-Hood Canal rivers population and populations within the Skokomish River and the South Puget Sound Region, which could serve as reserves, was also a factor. However, the primary reasons for the recommendation are the total abundance status of the population, the increasing escapement trend observed for the population, the annual monitoring and evaluation actions outlined in the RMP (discussed later in this document), and the likelihood that further decrease in the SUS fisheries-related impacts would have limited beneficial effects.

Strait of Juan de Fuca Region - The TRT delineated two populations within the Strait of Juan de Fuca Region: the Dungeness River and the Elwha River populations (see Figure 7). Both populations are classified as Category 1 populations (see Table 7). Although the TRT identified only two historically extant populations within the Strait of Juan de Fuca Region, important components of the historical diversity within the Strait of Juan de Fuca Region may have been lost (PSTRT 2003).

Genetically, the chinook salmon in the Elwha River are very distinct from other Puget Sound populations (see Figure 5a in PSTRT 2003). Chinook salmon in the Dungeness River are also genetically distinct from other populations in Puget Sound and appear intermediate in their characteristics between eastern Puget Sound and the Elwha River populations (PSTRT 2003). Habitat differences also exist between the Dungeness and Elwha River basins and other Puget Sound watersheds (PSTRT 2003).

In previous sections, NMFS found that the RMP provides sufficient protection for the Elwha River population. However, NMFS has identified a heightened level of concern for the Dungeness River population, primarily because of the current status of the populations, the annual anticipated escapement resulting from the implementation of the RMP is expected to approach the VSP-derived critical threshold of 200 for the population. A summary of the risk analysis for the Dungeness River population follows, but a more detailed analysis is provided in previous sections.

Dungeness River Population: Since listing, the average escapements of 345 fish for the Dungeness River population has been above the VSP generic guidance for a critical threshold of 200 fish for this population, but below the RMP's low abundance threshold of 500 fish. The Dungeness River population has exhibited an increasing escapement trend since listing (see Table 9). Modeling of the Dungeness Management Unit indicates that the co-managers would continue to meet or exceed the critical threshold of 200 natural spawners under the implementation of the RMP from May 1, 2005 through April 2010. The range of escapements to the Dungeness River under the implementation of the RMP is expected to be 231 to 356 fish (see Table 3). The most likely escapement within this range is 336 fish (see Table 5). The range of anticipated escapements is below the RMP's low abundance threshold of 500 fish and approaches the VSP generic guidance for a critical threshold of 200 fish for this population.

The co-managers, in cooperation with federal agencies and private-sector conservation groups, have implemented a captive brood stock program to rehabilitate chinook salmon runs in the Dungeness River. Juvenile and adult fish produced through the hatchery program on the Dungeness River are listed with the natural-origin fish under the ESA. The primary goal of the supplementation and an associated fishery restriction program is to increase the number of fish spawning naturally in the river, while maintaining the generic characteristics of the existing broodstock.

Although there are no fishery harvest distribution estimates for the Dungeness Management Unit, in the adjacent Elwha Management Unit, it is estimated that the Alaskan and Canadian harvests have represented, on average, almost 80 percent of the total fishery impacts. A similar Alaskan and Canadian harvest distribution is assumed for the Dungeness River population. Through modeling, the estimated range of exploitation rates that may be anticipated for the Dungeness Management Unit under the implementation of the RMP from May 1, 2005 through April 2010 is 22 to 29 percent. The most likely total exploitation rate within this range is 27 percent (see Table 14). However, the anticipated SUS exploitation rate for this population is very small; the SUS fisheries exploitation rate on this population is most likely to be 5 percent (see Table 5).

The co-managers will review the status of populations within the ESU annually. The co-managers, in cooperation with NMFS, will use this information to assess whether impacts on listed fish are as expected. When a population is anticipated to fall below its low abundance threshold, the co-managers have committed to consider additional actions when application of the RMP is not sufficiently protective in a given year, and when such additional actions would benefit the stocks.

NMFS concludes that the RMP would provide sufficient protection for the Strait of Juan de Fuca Region populations. This recommended determination takes into consideration that the conservation hatchery program operating in the Dungeness River buffers the demographic risk to the Dungeness River population. This recommended determination also considers the status and increasing escapement trend of the populations within this region, annual monitoring and evaluation outlined in the RMP (which will be discussed more later in this evaluation), the small anticipated SUS exploitation rate of less than five percent, and the likelihood that any further decrease in the SUS fisheries-related impacts would have limited beneficial effects on these populations. As discussed above and in previous sections, NMFS finds that the RMP's management objectives would be adequately protective of the geographic distribution, life history characteristics, and genetic diversity of populations within the Strait of Juan de Fuca Region of the ESU.

ESU Summary - The Puget Sound Chinook Salmon ESU, not the component, individual populations, is the primary focus of NMFS' evaluation of the impacts of the RMP under the ESA. In conducting this evaluation, NMFS takes into account the recommendations of the TRT, which is charged with identifying the biological characteristics of a recovered ESU as part of developing delisting and recovery criteria. As noted earlier, the TRT's preliminary recommendation is that any ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region. Biological criteria outlined in the ESA 4(d) Rule, NMFS' other mandates under the Endangered Species Act, and federal trust responsibilities to treaty Indian tribes will also be considered in developing NMFS' evaluation and resultant determination for the RMP.

NMFS concludes that the implementation of the RMP from May 1, 2005 through April 30, 2010, will adequately protect chinook salmon populations in the Georgia Straight Region based primarily on the increasing trends of the natural-origin populations, the additional contributions of hatchery-origin spawners to the natural spawning areas, and the low anticipated SUS exploitation rate. Additionally, NMFS' conclusion is based on information suggesting that past harvest constraints have had limited effect on increasing escapement of returning natural-origin fish, when compared with the return of hatchery-origin fish, and taking into consideration NMFS' treaty trust responsibility.

NMFS has determined that implementation of the proposed RMP will contribute to rebuilding for seven of the ten populations within the North Puget Sound Region. The life history and run timing characteristics of the three populations identified as having an elevated level of risk for rebuilding, are represented by the seven other populations in the region. Escapements for two of three "at risk" populations are currently above their identified viable thresholds, and all three populations have shown an increasing trend in escapement since listing. Therefore, NMFS concludes that the RMP's management objectives would be adequately protective of the geographic distribution, life history characteristics, and genetic diversity of the populations within the North Puget Sound Region of the ESU.

Through its evaluation, NMFS expects that the proposed RMP would contribute to the stabilization or rebuilding of all populations within the South Puget Sound Region. Specific harvest impacts identified for the two populations within the region, the Cedar River and Sammamish River populations, do not rise to a level that might represent a substantial risk to chinook salmon population rebuilding and recovery in the region when all populations are considered. Highlighting harvest impact concerns for these two populations is considered precautionary. Therefore, NMFS concludes that the RMP's management objectives are adequately protective of the geographic distribution, life history characteristics, and genetic diversity of the populations within the South Puget Sound Region of the ESU.

The RMP's management objectives are adequately protective of the geographic distribution, life history traits, and genetic diversity of the populations within the Hood Canal Region of the ESU. This conclusion is based on the production of the hatchery-origin fish that share the ecological and genetic traits of the natural-origin population, the status and increasing escapement trends of the two component populations, the annual monitoring and evaluation actions applied in the RMP to track population status and harvest impacts, the likelihood that further decrease in the SUS fisheries-related impacts would have limited effects on the persistence of the Mid-Hood Canal rivers population within this region, and the genetic similarity between the Mid-Hood

Canal rivers population and populations within the Skokomish River and the South Puget Sound Region.

NMFS concludes that the RMP will also provide adequate protection for chinook salmon originating from the Strait of Juan de Fuca Region. This recommended determination is based on the status and increasing escapement trends of the populations, the annual monitoring and evaluation actions outlined in the RMP, the low anticipated SUS exploitation rates, the likelihood that any further decrease in the SUS fisheries-related impacts would have limited beneficial effects on the persistence of these two populations, and on consideration that the hatchery-origin fish produced for conservation purposes in the two watersheds within this region share the ecological and genetic traits of the natural-origin populations.

Based on these conclusions and the analysis presented in previous sections, NMFS finds that the RMP's management objectives, in combination with other ongoing habitat and hatchery efforts, would provide adequate protection for each of the five regions of the ESU. NMFS finds that the RMP's management objectives adequately address the biological criteria outline in the ESA 4(d) Rule. Therefore, the NMFS Northwest Region, Sustainable Fisheries Division concludes that implementation of the RMP from May 1, 2005 through April 2010 would not appreciably reduce the likelihood of survival and recovery of the Puget Sound Chinook Salmon ESU in the wild**.**

(7) Section (b)(4)(i)(E) Includes effective (a) monitoring and (b) evaluation programs to assess compliance, effectiveness, and parameter validation *(Minimum requirement: collect catch and effort data, information on escapements, and information on biological characteristics, such as age, fecundity, size and sex data, and migration timing*).

The Puget Sound Indian Tribes and the WDFW, independently and jointly conduct a variety of research and monitoring programs. Chapter 7 of the RMP (starting on page 55) describes these monitoring programs which are used to assess effectiveness of the management actions in achieving the management objectives of the RMP and to validate the assumptions used in deriving the objectives. Information from research and monitoring programs will be used in conjunction with the performance indicators to assess the effectiveness of the RMP and revise management objectives and actions accordingly.

Chinook salmon harvest in all fisheries, including incidental catch and fishing effort, is monitored by the co-managers. Commercial catches within the Puget Sound Action Area are recorded on sales receipts ('tickets'), copies of which are sent to the WDFW and tribal agencies and recorded in a jointly-maintained database. A preliminary summary of catch and effort is available four months after the season, although a final, error-checked record may require a year or more to develop.

For Puget Sound fishing areas, recreational harvest is estimated from either creel census or from a sample of catch record cards obtained from anglers. The recreational fishery baseline sampling program provides auxiliary estimates of species composition, effort, and catch-per-unit-effort (CPUE) to the Salmon Catch Record Card System. The baseline sampling program is geographically stratified among the marine catch areas in Puget Sound. The objective of the sampling program is to sample 120 fish per stratum for estimation of species composition, and 100 boats per stratum for the estimation of CPUE.

Catch and effort summaries allow an assessment of the performance of fishery regulations in constraining catch to the desired levels. Time and area constraints, and gear limitations, are imposed by regulations, but with some uncertainty regarding their exact effect on harvest. For many management units, catch is often projected pre-season based on the modeled effect of specific regulations. Post-season comparison of estimated and actual catch allows for the assessment of the true effect of those regulations, and guides their future application or modification.

Incidental mortality in fisheries directed at other species or non-listed chinook salmon has comprised an increasingly large proportion of the total harvest mortality of Puget Sound chinook salmon. Non-landed mortality is accounted for in the RMP. Non-landed mortality is primarily addressed in the RMP's Chapter 4, the section on Non-Landed Fisheries Mortality (starting on page 26 in the RMP) and in Appendix B: Non-landed Mortality Rates of the RMP. Non-landed mortality is projected by averaging levels estimated across a recent period, either as total chinook salmon landed or as a proportion of the target species catch.

The co-managers estimate chinook salmon escapement from surveys in each river system. Escapement surveys provide information on run timing and population status. A variety of sampling and computational methods are used to calculate escapement, including cumulative redd counts, peak counts of live adults, cumulative carcass counts, and integration under escapement curves drawn from a series of live fish or redd counts. A more detailed description of methods used for Puget Sound systems is included in Appendix E: Puget Sound Chinook Escapement Estimates: Description and Assessment of the RMP.

Catch sampling and escapement surveys also provide biological data on age, length, sex, and size. Depending on the accuracy required of such estimates, more sampling effort may be required by the co-managers than has previously been expended on gathering basic biological data to determine age and sex composition and the effects of fisheries on these biological elements. State and tribal technical staffs are currently focusing attention on the improving design and implementation of these studies.

The performance of the fisheries during the life of the RMP will be assessed to determine the extent to which catch and fishing effort conform to the quotas, ceilings, or projections that were defined in pre-season planning for each fishing area and season. The assessment may lead to further evaluation of the effectiveness of fishing regulations (e.g. time or area constraints, gear restrictions, or bag limits), in future management plans. The causes of discrepancies between expected and actual catch and effort will be identified by the co-managers with a view to changing regulatory measures, and methods for projecting catch and fishing effort, to improve their accuracy.

Assessment of the total return requires accurate estimation of escapement and reconstruction of fishing-related mortality from coded-wire tag data or fishery simulation models. There will a time lag of approximately 18 months, after the conclusion of the fall fisheries, before tag recovery data are available to researchers. Tag recoveries from all intercepting fisheries, including those in Alaska and British Columbia, are required to complete the assessment. Accounting of the harvest fishing-related mortality and escapement for each management unit will enable the calculation of exploitation rates, which may be compared with the pre-season projections and objectives. Ultimately, reconstruction of all cohorts associated with a given brood year enables the calculation of brood-year exploitation rates.

Cohort reconstruction and estimation of exploitation rates from tag recovery data will also provide a means of assessing the accuracy of the fishery simulation models. Models predict unit-specific fishing-related mortality by scaling the abundance of all contributing populations, and the fishing effort anticipated in each area and season, against those in a base period. Tag-based run reconstruction provides an alternative and independent estimate of the total fishing-related mortality and harvest distribution of each management unit or population. The errors detected in the simulation model, whether they be associated with abundance forecasts or computation of harvest, will be quantified and taken into account in developing harvest objectives and fishery planning so that fishery management planning will be robust to those errors.

Cohort reconstruction for each management unit is the fundamental monitor of productivity. As discussed above, the productivity of each management unit or population guides the development and adjustment of exploitation rate objectives. Those objectives must conform to the most recent values and trends in population productivity. However, many management units do not have sufficient data on productivity to detect changes. Periodically, the population/recruit function will be updated, and the exploitation rates and thresholds re-assessed, for each management unit. The tasks involved in monitoring abundance and productivity, and assessing the performance of annual fishing regimes, is mandated by the Puget Sound Salmon Management Plan (PSSMP 1985).

In addition to the monitoring programs discussed in the RMP, there are numerous other ongoing projects funded by other agencies or programs which provide additional information useful for fisheries management. Each year, the Salmon Recovery Funding Board provides funding for projects designed to further salmon recovery. Limiting factor analyses are being conducted for each major watershed within Washington State (WSCC 2000). The results of these analyses will be important for parameter validation and management objective revision as necessary. Data collection and monitoring programs included in Hatchery and Genetic Management Plans implemented within the Puget Sound region will also provide valuable information on stray rates and patterns, and contribution of hatchery fish to escapements.

(8) Section (b)(4)(i)(F) Provides for (a) evaluating monitoring data; and (b) making any revisions of assumptions, management strategies, or objectives that data show are needed.

A description of how WDFW and the PSTT will evaluate the monitoring data and compile a report of the findings can be found in Chapter 7 of the RMP, in the Annual Chinook Management Report section, and in Appendix E: Puget Sound Chinook Escapement Estimates: Description and Assessment of the RMP.

State and tribal technical staff will meet periodically in-season to exchange information and data, achieve consensus on in-season management actions, and prepare post-season reports. Additional meetings and exchanges will occur as needed to develop recommendations for management units' harvest regimes pertinent to the RMP, resolve differences in approach, and review monitoring program results. Data from the monitoring programs form the basis for development and refinement of forecasting and assessment efforts.

The RMP's critical exploitation rate ceilings were established by the co-managers, after policy consideration of the recent fisheries regimes that responded to critical status for some management units. If substantial changes are made to the model, these ceilings may be adjusted in consultation with NMFS (see page 17 of the RMP).

The co-managers will notify NMFS when in-season actions are expected to deviate substantially from preseason expectations, e.g., increase an exploitation rate to a management unit's ceiling rate or reduce the expected escapement level to below the management unit's low abundance threshold (see page 38 of the RMP). The notification will include a description of the change, an assessment of the anticipated fishing mortality resulting from the change, and an explanation of how impacts of the action maintains consistency with the Puget Sound chinook salmon harvest management plan.

The annual post-season review of the management plan is part of the annual pre-season planning process. The post-season review is necessary to permit an assessment of the co-managers' annual management performance in achieving spawning escapement, harvest, and allocation objectives. The co-managers will review each population's status annually and, where needed, identify actions required to improve estimation procedures and correcting bias. As appropriate, measures will be derived to address deleterious effects on size, age or sex selectivity. Such improvements provide greater assurance that management objectives will be achieved in future seasons. The effort builds a remedial response into the pre-season planning process to prevent excessive fishing-related mortality levels relative to the conservation of a management unit.

The annual post-season reports will be completed by mid-February of each year over the term of the RMP (see page 55 of the RMP). A copy will be provided to NMFS. The review of the harvest management plan will include: a fisheries summary; harvest levels; non-landed mortality; estimated escapement; an exploitation rate assessment; and the cohort reconstruction. It will also include consideration of the information developed through the recovery planning efforts of the TRT. Future revisions to the Puget Sound chinook salmon management plan will occur if comprehensive technical review of the available information indicates that a modification would be beneficial to achieving the goals of the RMP. The results of the post-season reports will also be used to shape future fishery management plans in order to increase the effectiveness of the harvest regime and decrease uncertainty. Escapements will be monitored to evaluate whether the exploitation rates have contributed to stabilizing or increasing escapements.

(9) Section (b)(4)(i)(G) Provides for (a) effective enforcement, (b) education, (c) coordination among involved jurisdictions.

The description of the RMP's enforcement and education programs can be found in Chapter 5 - Fisheries and Jurisdictions, starting on page 38 of the RMP. The RMP relies on a pre-season planning process to set the initial harvest regimes (fishing schedules and seasons) for all management units. The setting of the Puget Sound fisheries schedules and seasons occurs concurrently with the planning of the Washington and Oregon coastal fisheries. The pre-season planning process will occur from March through early-April, during the North of Cape Falcon forums. The forum is open to the public, allowing the public access to salmon status information, and providing the public an opportunity to interact with the co-managers.

Regulations enacted during the season will implement guidelines established during the pre-season planning process described above, but may be modified based on in-season assessments of effort, catch, abundance, and escapement. However, in many areas, the co-managers lack the necessary tools to detect in-season deviations from the pre-season forecast in time to adjust regulations. Any in-season modifications will be in accordance with the procedures specified in the Puget Sound Salmon Management Plan (PSSMP 1985) and subsequent court orders.

The WDFW and individual treaty tribes are responsible for regulation of harvest in fisheries under their authority, consistent with the principles and procedures set forth in the Puget Sound Salmon Management Plan. Fisheries will be regulated to achieve sharing and production objectives based on four fundamental elements: (1) acceptably accurate determination of the appropriate exploitation rate, harvest rate, or numbers of fish available for harvest; (2) the ability to evaluate the effects of specific fishing regulations; (3) a means to monitor fishing activity in a sufficient, timely and accurate fashion; and (4) effective regulation of fisheries to meet objectives for spawning escapement and fishery impact limitations.

Commercial fishery regulations are promulgated by WDFW and by each tribe. The co-managers maintain a system for transmitting commercial fishing regulations electronically to all interested parties (including NMFS), in a timely manner, prior to and during all fisheries. Regulations are stored in paper and electronic format by WDFW, each tribe, and the Northwest Indian Fisheries Commission. Commercial fishery regulations for some fisheries are also available through telephone hotlines maintained by WDFW, the Northwest Indian Fisheries Commission, and individual tribes. The WDFW publishes regulations for recreational fisheries in a widely distributed pamphlet. WDFW regulations, and in-season regulation changes, are also published on their website (*www.wa.gov/wdfw*).

Non-tribal commercial and recreational fishery regulations are enforced by the WDFW. The WDFW Enforcement Program currently employs 163 personnel. Of that number, 156 are fully commissioned Fish and Wildlife staff who ensure compliance with licensing and habitat requirements, and enforce prohibitions against the illegal taking or poaching of fish and wildlife (WDFW 2003). The Fish and Wildlife Enforcement Program is primarily responsible for enforcing the Washington State Fish and Wildlife Code. However, officers are also charged with enforcing many other codes as well, and are often called upon to assist their local city/county, and other state law enforcement agencies, and tribal authorities. On average, officers currently make more than 300,000 public contacts annually. The WDFW Enforcement staff also works cooperatively with the United States Fish and Wildlife Service, NMFS Enforcement branch, and the United Sates Coast Guard.

Each tribe exercises authority over enforcement of tribal commercial fishing regulations, whether fisheries occur on or off their reservation. In some cases enforcement is coordinated among several tribes by a single agency (such as the Point No Point Treaty Council, which is entrusted with enforcement authority over Lower Elwha Klallam, Jamestown S'Klallam, and Port Gamble S'Klallam tribal fisheries). Enforcement officers of one tribal agency may be cross-deputized by another tribal agency, where those tribes fish in common areas. Prosecution of violations of tribal regulations occurs through tribal courts and governmental structures.

The co-managers maintain a system for transmitting, cross-indexing and storing fishery regulations affecting harvest of salmon. Both WDFW and the Puget Sound Tribes monitor and enforce compliance with these regulations as part of more extensive enforcement programs. The co-managers' and federal court systems are expected to be sufficient to ensure that enforcement is followed through with appropriate prosecution of violators.

The PSTT and WDFW have direct management authority over fisheries harvesting Puget Sound chinook salmon in Puget Sound. The Pacific Salmon Commission, Pacific Fishery Management Council, and North of Falcon meetings will provide the forums for coordination among jurisdictions impacting Puget Sound chinook salmon populations. The fishery regimes developed each year as an outcome of these planning forums account for fishing-related mortality in all fisheries in the United States and Canada. They also help to ensure that fisheries are consistent with the management objectives and approach described in the RMP. The RMP's rebuilding exploitation rate objectives for the Puget Sound chinook salmon management units will be submitted to the Pacific Fishery Management Council for inclusion into the federal management plan for West Coast ocean salmon fisheries. Fishing-related mortality of Puget Sound chinook salmon in Alaska and Canadian fisheries is constrained by the terms of the Pacific Salmon Treaty agreement (PST 1999).

Both the Pacific Fishery Management Council and North of Falcon fishery planning processes are open to the public. The Council takes public comment and input throughout its development of fishing regimes for the ocean fisheries off Washington, Oregon and California. Representatives from the commercial and recreational fishing constituencies are active participants in the North of Falcon planning process. Public notification of fishery regulations is achieved through press releases, regulation pamphlets, telephone hotlines, and Federal Register notices. The WDFW has recently implemented a more aggressive campaign to increase public involvement and education through expanded public meetings, and greater access to information through use of the Internet.

(10) Section (b)(4)(i)(H) Includes restrictions on resident and anadromous species fisheries that minimize any take of listed species, including time, size, gear, and area restrictions.

The RMP's rebuilding exploitation rates, upper management thresholds, low abundance thresholds, and the critical exploitation rate ceilings are the primary elements of the harvest plan.

Time, size, gear and area and retention restrictions are all among the actions taken to ensure that salmon fishing-related mortality is consistent with these management objectives. Chinook salmon-directed fisheries in some terminal areas have been closed for years, and in other areas, fisheries on other species and healthy hatchery populations are restricted or delayed to protect naturally spawning chinook salmon.

Actions the co-managers have taken in the past and that will be considered under the RMP to protect listed species include: closures in the April, May, and June recreational fisheries and size limits to protect spring chinook salmon; closed spawning grounds to fishing; and required non-retention of chinook salmon. Both commercial and recreational fisheries have instituted closures around river mouths where chinook salmon concentrate before moving upstream.

Juvenile yearling life stage spring chinook salmon are not typically vulnerable to being caught in the fisheries subject to the RMP because of the juvenile's feeding habits and small size. Juvenile chinook salmon are rarely caught in any Puget Sound fishery. Nets are the primary commercial gear used in Puget Sound and the mesh is generally too large to ensnare juveniles.

Recreational fisheries in areas throughout Puget Sound have regulations that will reduce the potential mortality of juvenile chinook salmon. These regulations include the use of barbless hooks, minimum size requirements, and catch-and-release-only fishing. Puget Sound freshwater salmon recreational fisheries are concentrated during the period of adult return (July, August, September, and October), typically well after the majority of juveniles have emigrated from freshwater.

(11) Section (b)(4)(i)(I) Is consistent with other plans and conditions established within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.

The RMP explicitly states in its general principles that it will comply with the requirements of *U.S. v. Washington*, *U.S. v. Oregon*, other applicable federal court orders, and the Pacific Salmon Treaty (see page 4 of the RMP).

Recommended Determination:

The co-managers' RMP for Puget Sound fisheries potentially affecting listed Puget Sound chinook salmon from May 1, 2004, through April 30, 2010 has been evaluated, pursuant to 50 CFR 223.209 (Tribal Rule) and the government-to government processes therein.

NMFS Northwest Region's Sustainable Fisheries Division recommends that the National Marine Fisheries Service determine under 50 CFR 223.203(b)(6) that:

(i) implementing and enforcing the RMP will not appreciably reduce the likelihood of survival and recovery of the Puget Sound Chinook Salmon ESU; and

(ii) the RMP will be implemented and enforced within the parameters set forth in *United States v. Washington* or *United States v. Oregon*.

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Appendix A

Model Results:
Implementation of the RMP

Appendix A1. Anticipated exploitation rates and escapements for Puget Sound chinook salmon by management unit under the RMP, FRAM run number 30P3.

Abundance: 30 Percent Reduction of 2003
Canadian: 2003 Level

Management Unit	Population [1]	Anticipated Total Exploitation Rate	Anticipated SUS Exploitation Rate	Anticipated Pre-terminal SUS Exploitation Rate	Anticipated Escapement	Aspects of the Minimum Fisheries Regime Imposed [2]
Nooksack	Natural-Origin Spawner:	20%	7%	3%	278	Yes
	North Fork Nooksack	-	-	-	125	
	South Fork Nooksack	-	-	-	153	
Skagit Summer/ Fall [3]	Natural Spawners:	49%	18%	9%	8,003	No
	Upper Skagit River	-	-	-	6,743	
	Lower Sauk River	-	-	-	428	
	Lower Skagit River	-	-	-	861	
Skagit Spring	Natural Spawners:	23%	14%	12%	1,331	No
	Upper Sauk River	-	-	-	493	
	Suiattle River	-	-	-	448	
	Upper Cascade River	-	-	-	389	
Stillaguamish	Natural-Origin Spawners:	17%	12%	10%	1,620	No
	N.F. Stillaguamish River	-	-	-	1,321	
	S.F. Stillaguamish River	-	-	-	299	
Snohomish	Natural-Origin Spawners:	20%	14%	11%	3,543	Yes
	Skykomish River	-	-	-	1,724	
	Snoqualmie River	-	-	-	1,819	
Lake Washington	Natural Spawners:	33%	23%	9%	446	No
	Cedar River	-	-	-	223	
	Sammamish River	-	-	-	223	
Green	Natural Spawners:					No

	Duwamish-Green River	49%	39%	9%	5,801	
White	Natural Spawners: White River	20%	19%	8%	1,011	No
Puyallup	Natural Spawners: Puyallup River	50%	39%	9%	1,798	No
Nisqually	Natural Spawners: Nisqually River	64%	56%	24%	1,119	No
Skokomish	Natural Spawners: Skokomish River	45%	31%	12%	1,239	Yes
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	26%	12%	12%	367	Yes
Dungeness	Natural Spawners: Dungeness River	22%	5%	4%	245	No
Elwha	Natural Spawners: Elwha River	23%	5%	4%	1,480	No

[1] A natural-origin spawner (NOR) is any naturally spawning salmon that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Unless other wise note, exploitation rate and escapement are natural spawners. Natural spawner is any naturally spawning salmon (hatchery plus natural-origin).

[2] A general description of these minimal fisheries, as proposed by the co-managers, is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

[3] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent rears, 6 to 18 percent exploitation rates.

Appendix A2. Anticipated exploitation rates and escapements for Puget Sound chinook salmon by management unit under the RMP, FRAM run number 30M2.

Abundance: 30 Percent Reduction of 2003
Canadian: Maximum allowed under Pacific Salmon Treaty

Management Unit	Population [1]	Anticipated Total Exploitation Rate	Anticipated SUS Exploitation Rate	Anticipated Pre-terminal SUS Exploitation Rate	Anticipated Escapement	Aspects of the Minimum Fisheries Regime Imposed [2]
Nooksack	Natural-Origin Spawner:	26%	7%	2%	252	Yes
	North Fork Nooksack	-	-	-	113	
	South Fork Nooksack	-	-	-	139	
Skagit Summer/Fall [3]	Natural Spawners:	56%	16%	8%	7,551	Yes
	Upper Skagit River	-	-	-	6,339	
	Lower Sauk River	-	-	-	403	
	Lower Skagit River	-	-	-	809	
Skagit Spring	Natural Spawners:	28%	15%	13%	1,270	No
	Upper Sauk River	-	-	-	470	
	Suiattle River	-	-	-	428	
	Upper Cascade River	-	-	-	371	
Stillaguamish	Natural-Origin Spawners:	20%	12%	11%	1,584	No
	N.F. Stillaguamish River	-	-	-	1,291	
	S.F. Stillaguamish River	-	-	-	293	
Snohomish	Natural-Origin Spawners:	23%	14%	12%	3,399	Yes
	Skykomish River	-	-	-	1,654	
	Snoqualmie River	-	-	-	1,745	
Lake Washington	Natural Spawners:	38%	22%	9%	428	No
	Cedar River	-	-	-	214	
	Sammamish River	-	-	-	214	
Green	Natural Spawners:					

	Duwamish-Green River	51%	36%	9%	5,802	No
White	Natural Spawners: White River	20%	17%	9%	1,011	No
Puyallup	Natural Spawners: Puyallup River	50%	35%	9%	1,834	No
Nisqually	Natural Spawners: Nisqually River	66%	53%	25%	1,109	No
Skokomish	Natural Spawners: Skokomish River	48%	26%	12%	1,225	Yes
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	34%	12%	12%	344	Yes
Dungeness	Natural Spawners: Dungeness River	29%	5%	5%	231	Yes
Elwha	Natural Spawners: Elwha River	30%	5%	4%	1,395	No

[1] A natural-origin spawner (NOR) is any naturally spawning salmon that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Unless other wise note, exploitation rate and escapement are natural spawners. Natural spawner is any naturally spawning salmon (hatchery plus natural-origin).

[2] A general description of these minimal fisheries, as proposed by the co-managers, is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

[3] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent rears, 6 to 18 percent exploitation rates.

Appendix A3. Anticipated exploitation rates and escapements for Puget Sound chinook salmon by management unit under the RMP, FRAM run number AEQ1.

Abundance: 2003 Level
Canadian: 2003 Level

Management Unit	Population [1]	Anticipated Total Exploitation Rate	Anticipated SUS Exploitation Rate	Anticipated Pre-terminal SUS Exploitation Rate	Anticipated Escapement	Aspects of the Minimum Fisheries Regime Imposed [2]
Nooksack	Natural-Origin Spawner: North Fork Nooksack South Fork Nooksack	20% - -	7% - -	3% - -	388 174 214	Yes
Skagit Summer/Fall [3]	Natural Spawners: Upper Skagit River Lower Sauk River Lower Skagit River	48% - - -	18% - - -	9% - - -	11,633 9,765 620 1,247	No
Skagit Spring	Natural Spawners: Upper Sauk River Suiattle River Upper Cascade River	23% - - -	14% - - -	13% - - -	1,921 711 647 562	No
Stillaguamish	Natural-Origin Spawners: N.F. Stillaguamish River S.F. Stillaguamish River	17% - -	11% - -	10% - -	2,322 1,893 429	No
Snohomish	Natural-Origin Spawners: Skykomish River Snoqualmie River	19% - -	14% - -	11% - -	5,073 2,468 2,604	No
Lake Washington	Natural Spawners: Cedar River Sammamish River	31% - -	20% - -	10% - -	610 305 305	No
Green	Natural Spawners:					

	Duwamish-Green River	62%	51%	10%	5,819	No
White	Natural Spawners: White River	20%	19%	9%	1,468	No
Puyallup	Natural Spawners: Puyallup River	49%	39%	10%	2,392	No
Nisqually	Natural Spawners: Nisqually River	76%	68%	26%	1,106	No
Skokomish	Natural Spawners: Skokomish River	63%	50%	13%	1,211	Yes
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	26%	13%	13%	531	No
Dungeness	Natural Spawners: Dungeness River	22%	5%	5%	352	Yes
Elwha	Natural Spawners: Elwha River	22%	5%	5%	2,125	No

[1] A natural-origin spawner (NOR) is any naturally spawning salmon that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Unless other wise note, exploitation rate and escapement are natural spawners. Natural spawner is any naturally spawning salmon (hatchery plus natural-origin).

[2] A general description of these minimal fisheries, as proposed by the co-managers, is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

[3] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent rears, 6 to 18 percent exploitation rates.

Appendix A4. Anticipated exploitation rates and escapements for Puget Sound chinook salmon by management unit under the RMP, FRAM run number 03m2.

Abundance: 2003 Level
Canadian: Maximum allowed under Pacific Salmon Treaty

Management Unit	Population [1]	Anticipated Total Exploitation Rate	Anticipated SUS Exploitation Rate	Anticipated Pre-terminal SUS Exploitation Rate	Anticipated Escapement	Aspects of the Minimum Fisheries Regime Imposed [2]
Nooksack	Natural-Origin Spawner:	25%	7%	2%	365	Yes
	North Fork Nooksack	-	-	-	164	
	South Fork Nooksack	-	-	-	201	
Skagit Summer/Fall [3]	Natural Spawners:	55%	16%	8%	11,029	Yes
	Upper Skagit River	-	-	-	9,258	
	Lower Sauk River	-	-	-	588	
	Lower Skagit River	-	-	-	1,182	
Skagit Spring	Natural Spawners:	27%	14%	13%	1,845	No
	Upper Sauk River	-	-	-	683	
	Suiattle River	-	-	-	621	
	Upper Cascade River	-	-	-	539	
Stillaguamish	Natural-Origin Spawners:	19%	11%	10%	2,281	No
	N.F. Stillaguamish River	-	-	-	1,860	
	S.F. Stillaguamish River	-	-	-	421	
Snohomish	Natural-Origin Spawners:	22%	13%	11%	4,901	Yes
	Skykomish River	-	-	-	2,385	
	Snoqualmie River	-	-	-	2,516	
Lake Washington	Natural Spawners:	35%	20%	10%	588	No
	Cedar River	-	-	-	294	
	Sammamish River	-	-	-	294	
Green	Natural Spawners:					

	Duwamish-Green River	63%	47%	10%	5,816	No
White	Natural Spawners: White River	20%	18%	9%	1,459	No
Puyallup	Natural Spawners: Puyallup River	50%	35%	10%	2,419	No
Nisqually	Natural Spawners: Nisqually River	76%	65%	26%	1,126	No
Skokomish	Natural Spawners: Skokomish River	63%	44%	12%	1,237	Yes
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	32%	13%	12%	504	No
Dungeness	Natural Spawners: Dungeness River	27%	5%	4%	336	Yes
Elwha	Natural Spawners: Elwha River	28%	5%	4%	2,031	No

[1] A natural-origin spawner (NOR) is any naturally spawning salmon that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Unless other wise note, exploitation rate and escapement are natural spawners. Natural spawner is any naturally spawning salmon (hatchery plus natural-origin).

[2] A general description of these minimal fisheries, as proposed by the co-managers, is outlined in Appendix C: Minimum Fisheries Regime of the RMP.

[3] Based on Skagit Summer/Fall Management Unit modeling, which assumes 2003 fisheries and abundance. Anomalous age structure and the presence of pink salmon fisheries in 2003 make the estimates of exploitation rates used in this modeling a likely overestimate of the harvest impacts. The SUS exploitation rates are more likely to be similar to recent rears, 6 to 18 percent exploitation rates.